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GOD AND THE UNIVERSE

A PHYSICAL BASIS FOR RELIGION AND ETHICS

G. W. DE TUNZELMANN, B.Sc.

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Expanded from Lectures delivered at Manchester in 1910, and at Sion College and the University of London, University College, in 1911

BY

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PUBLISHED UNDER THE DIRECTION OF THE CHRISTIAN EVIDENCE COMMITTEE

SOCIETY FOR PROMOTING CHRISTIAN KNOWLEDGE
LONDON: NORTHUMBERLAND AVENUE, W.C.
43 QUEEN VICTORIA STREET, E.C.
BRIGHTON: 129 NORTH STREET
NEW YORK: E. S. GORHAM

1912

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PREFACE

This volume is mainly a reproduction of a course of lectures, originally delivered in 1910, at St. Ann's Church Schools, Manchester, at the suggestion of the Bishop, Dr. Knox, and with his active support and co-operation. They bore the title, *Modern Physics and Rational Ethics*, and were announced under the heading, *The Destruction of Atheism by Modern Science*. The earlier lectures consisted of a popular rendering, with some extensions, of the argument developed in my *Treatise on Electrical Theory and the Problem of the Universe*, which proved that the standpoint which has now been attained in physics provides a definite scientific basis for a rational Theism, and leaves no standing-place for either Atheism or Agnosticism except that of ignorance.

The reception accorded to this work by the scientific press of Europe and America, as well as by individual leaders of scientific thought, shows that the main argument has been accepted as an adequate interpretation of the present outlook of physical science, and I am not aware of any attempt having being made to disprove its validity.

The last two lectures of the course were devoted to showing how the standpoint attained provided a sound foundation for the general outlines of a rational theory for the guidance of national social

progress, and for the destructive criticism of the schemes of regress and disintegration which are being widely advocated by uninstructed enthusiasts, often with the best intentions.

The Manchester lectures were attended by many of the Anglican and Roman clergy, Nonconformist ministers, and laymen, and before the conclusion of the course I was favoured with very gratifying testimony to their usefulness, and to the interest which had been aroused by the presentation of the arguments to the congregations of some of those who were present.

The lectures were repeated in London, in 1911, at Sion College (at the suggestion of the Bishop of Kensington, acting for the Bishop of London), to a larger audience than the Manchester one, but of very similar composition. In response to further requests for repetition of the lectures, they were finally delivered at the London University, University College (by kind consent of the University College Committee).

In revising the lectures for publication some substantial additions have been made, including the two chapters on "Bergson and Bradley", and on "Christianity the Crown and Completion of Rational Theism". In the former I have included, by special request, and after the proofs were in type, a brief criticism of Professor Schäfer's Presidential Address to the British Association at Dundee. The latter chapter has been added in response to numerous requests from ministers of religion, and in writing it I have strictly confined myself to the consideration of those aspects of the life of

Jesus Christ and of His teaching which were within the scope of the argument which I have attempted to develop, refraining from mere expressions of opinion, which are of individual interest only.

I have dealt with the energy world-model at considerably greater length in chapter iii than was possible within the limits of time of a single lecture, and I trust that by so doing I have made it easier to follow.

In chapter iv the proof of the actual existence of finite universal mind as a fact of observation is new. Simple as it is, it did not present itself to me until I was revising the lectures for publication.

The confirmation of my own argument by the very different ones of Dr. Laurie and Professor Royce constitute the principal additions to chapter v. I only became aware of Professor Royce's work after the final delivery of the lectures, and limits of time prevented more than a brief reference to that of Dr. Laurie, which I had become aware of shortly after the *Treatise on Electrical Theory and the Problem of the Universe* had finally gone to press.

In conclusion, I have to thank the Rev. E. McClure and the members of the S.P.C.K. Committee for their kind assistance in reading the proofs and for several valuable suggestions.

G. W. DE TUNZELMANN.

LONDON, *October 28, 1912.*

CHAPTER I

INTRODUCTORY

SUMMARY

The recent change in the relations between Religion and Science. The scientific conception of God is the conception of St. Augustine. The fundamental truths expressed in the Book of Genesis. The Atomic Theories commonly attributed to Democritus and their relation to the theories of the Vedanta. The waning of Atheistic Materialism on the advent of Christianity; its recrudescence through misconception of the work of the great founders of Modern Physics; and its final eradication from the field of thought by the advance of Science. Science and Superstition. Haeckel's *Riddle of the Universe* an example of descent from the scientific standpoint to the standpoint of superstition.

A VERY significant indication of the great change which has taken place, since the closing years of the nineteenth century, in the relations between Religion and Science, was afforded by a statement made by the Archbishop of York, in the course of a sermon delivered at Sheffield during the 1910 meeting of the British Association at that place. His statement was to the effect that a truce of God had been proclaimed between the armies of Religion and the armies of Science, and that the long-standing conflict was now represented only by disputes between the camp-followers on either side. Speaking from the scientific side, I am able to say, not only that the archbishop's description of the changed relations between Religion and Science in no respect exceeded the limits of truth, but that it was rather an understatement of the facts. For those who, at the present time, endeavour to attack the theistic foundations which lie at the base of every form of religious belief find themselves compelled, in order to clear the way for their onset, to

embark upon the hopeless enterprise of attempting to destroy the very foundations of Physical Science. The time has therefore come for the armies of religion boldly to assume the offensive in their resistance to the atheistic propaganda amongst the ill-informed and uneducated, armed with the knowledge that on their side are the battalions and the artillery of modern science, and that ranged against them they have but dummy guns mounted upon fortifications of painted cardboard.

The change of attitude which has made this united action possible has operated far more amongst the rank and file on either side than amongst the great leaders. The greater physicists, like the greater philosophers, of all ages, have felt, as it were intuitively, the existence of creative and directive power, although to many, and at some periods to most, of their followers it seemed to be shut out from the sphere of clear scientific vision by a veil of impenetrable mist. The most recent advances in science have now made such rents in this veil, that a glimpse of what lies beyond is no longer confined to the piercing insight of the very highest minds, but is attainable to every trained mind that is honestly and earnestly seeking for the truth, and not simply for the means of supporting preconceived hypotheses. The glimpses so obtained are not glimpses of a power acting irregularly and intermittently, and serving to bridge over the gaps still existing in the scientific presentation of the universe. They are, on the contrary, glimpses of an all-pervading, ever-acting intelligence, of which the scientific presentation is but the vesture. The concept is one which could not find more adequate expression than in the noble words of St. Augustine, "God, above whom is nothing, outside whom is nothing, without whom is nothing: God, beneath whom is the whole, in whom is the whole, with whom is the whole."

By the rank and file of religion, however, God has been conceived as living in the gaps of the scientific scheme, as Professor Drummond has expressed it. The average religious man has therefore regarded every advance of scientific knowledge, every bridge thrown across these gaps, with a fearful apprehension, unacknowledged perhaps even to himself, but none the less real, that the sphere of God's action was being gradually contracted until ultimately it would become evanescent. One of the many benefits which popular theology has derived from the conflict with science has been the eradication of a concept so utterly unscientific. Science has no place for the anthropomorphic concept of an architect who has constructed the universe like a beautifully designed machine which, when once set in action, will continue to run, independently of its maker, except perhaps for occasional minor adjustments and corrections.

Two fundamental truths are expressed in the Book of Genesis: "In the beginning God created the heaven and the earth"; and "God created man in His own image, in the image of God created He him; male and female created He them." There is no trace here of the crude anthropomorphism which is so often ascribed to the ancient seer who expressed himself in these words. The very form of the statement that man, consisting of the two embodiments male and female, was created in the image of the one God, completely excludes an interpretation which would make the expression "image" apply to bodily form, and therefore carry the further implication that God was simply a magnified man, having a bodily shape of His own. The meaning of the creation of man in the image of God is made clear a little further on by the second expression of the same fact in the form that God "breathed into his nostrils the breath of life; and man became a living soul." No man can deny the first of these propositions and yet at the same time

intelligently accept the presentation of the world offered by modern science, as will be completely demonstrated in this volume. I shall endeavour, moreover, to show that the second proposition necessarily follows as a philosophical consequence of the same presentation.

The ancient world-conceptions of the Vedantic philosophy, which were taught by word of mouth in the forests of India more than three thousand years ago, bear, in their main outline, a wonderfully close resemblance to the results attained by the most recent scientific research. The ancient Indian thinker, and it is the same in the case of his representative of to-day, did not ask for a proof that God exists. God's existence was as real to him as his own, and the existence of God as the Eternal Self-consciousness was taken as the starting-point of a world-conception evolved entirely by introspective contemplation, on the simple basis of the absolute unity of the ultimate reality. From Brahm, the Eternally Self-existent, proceeded the first manifestation of God in the form of mind. From mind was evolved energy, although, of course, the ancient Vedantic concept which I express by the word energy was not defined with the scientific precision which now belongs to that term. From energy proceeded a series of ethers, which the sages of the *Vedanta* declared to be seven in number; and from the last of these were evolved in succession the different forms of matter.

In ancient Greek philosophy the atomic theories, commonly attributed to Democritus, are of such a kind as strongly to suggest their derivation from a misconception of the ancient Vedantic teaching. It is stated in the ninth edition of the *Encyclopaedia Britannica*[1], that Democritus was said by early classical writers to have visited the East, and if this were the case he might well have come into contact with

[1] Article on Democritus.

Vedantic philosophy. Professor Hope Moulton, a leading authority, informs me that he dissents from this view, and if he be right, then the contact between western and eastern thought must have occurred at a later—but still comparatively early—stage; for the similarity between the series of pre-Newtonian ethers and those of the Vedantic sages is so striking that it scarcely seems conceivable that the former should have had an independent origin. However this may be, the world-conception of Democritus contained no suggestion of an origin in the Eternal Self-consciousness, but regarded the material atoms as the ultimate world-realities, so giving birth to atheistic materialism. This view of the world practically disappeared on the advent of Christianity. It reappeared, however, at a later stage, as a consequence of complete misconception of the meaning of the results achieved by Huygens, Galileo, Newton, Laplace, Lagrange, and their great contemporaries and successors. It is only within the last decade or so that the atheistic belief arising in this manner has received its final quietus through the advance of scientific thought and knowledge, although materialism as a world system had vanished at the first touch of real philosophy, even as the morning mist vanishes in the rays of the rising sun.

Within the last few years a determined attempt has been made to effect a revival of atheistic belief amongst the uninformed and uneducated classes. This propaganda is being carried out by the simple and effective method of clothing effete superstitions in the cast-off rags of science, garnered from the dust-heaps of discarded hypotheses which strew the path of scientific advance upon every side.

Science and superstition ever have been, and ever will be, deadly foes. In the first place they are rivals. Their objects are similar, each aiming at the explanation of isolated facts by including them in general

statements. The first step made by each is the same, a guess. Science calls this guess a hypothesis, brings it into comparison with fact after fact, and if inconsistent with any observed fact, casts the hypothesis remorselessly aside to be replaced by one more satisfying. Superstition, on the other hand, calls its guess a fact; it does not attempt to compare it with real facts, and if real facts tending to disprove it are brought forward, it either denies their existence or attempts to evade the inferences founded upon them.

The present atheistic propaganda is almost entirely founded upon Professor Haeckel's *Riddle of the Universe*, a popular work full of fallacies, at which the man of science only smiles a smile of pity at the author's woful descent from the high position which he had once attained as a scientific worker. Sir Oliver Lodge has stated that it is impossible for a physicist to discuss, within the terms of courtesy, the physical hypotheses which form the basis of this work. Professor Haeckel has, however, himself pointed out a way in which this may be done without in any way transcending the limits of personal courtesy. For he has not hesitated to account for the condemnation of his wild and utterly unscientific views by such men as du Bois Reymond and his own teachers Baer and Virchow, by attributing to them a gradual psychological change with advancing years, leading them from the standpoint of science towards that of dogmatism and superstition. He has even attributed the same metamorphosis to such intellectual giants as Kant and Newton. Therefore there can be nothing offensive in calling attention to the excellent example of such a transformation which Haeckel himself presents; and I have elsewhere described in detail the various stages of his descent to the very nadir of superstition, as expressed in his futile assault upon the foundations of physical science. Carried away by his intense animosity to every form of Theism, he

actually believes it possible to destroy the foundations of dynamics, as laid by Galileo, Huygens, Newton, Laplace, and their contemporaries and successors, and to replace them by an incoherent conglomerate of the ideas of Empedocles, whom Aristotle called the "Father of Rhetoric", of Democritus, and of Lucretius.[1] This conglomerate proves, on examination, to be a very crude Polytheism. I have shown, moreover, in an earlier work [2] that the acceptance of Haeckel's hypotheses, in so far as they are consistent with each other and with observed physical facts, would necessarily lead to the conclusion that the basis of all observed phenomena is a purposive intelligent unity: the same conclusion that will be developed in the following pages directly from the observed phenomena of nature.

[1] See *The Superstition called Socialism*, ch. xi.

[2] *A Treatise on Electrical Theory and the Problem of the Universe*, p. 625. This work will be referred to hereafter under the shorter title of *Problem of the Universe*. See also p. 127 of this volume.

CHAPTER II

THE MECHANICAL WORLD-MODEL

SUMMARY

The direct contemplation of the universe as a whole merely overwhelms the human mind, giving rise to emotions of wonder and awe; no definite conceptions of its nature are, however, attainable in this way.

The only conceivable method of obtaining such conceptions is to dissect out small portions of the whole and consider them separately. But this cannot be effected without thereby transforming the separated portions themselves, so that no portion of the universe as it really is, but only a simplified representation or model of it, is accessible to scientific investigation.

The first and simplest model of the universe, which has been constructed by scientific workers, represents it as a mechanism, or machine, consisting of a number of groups, each of which contains a large number of similar elements, masses of sensible size, moving relatively to one another.

Every part of such a model must, from the method of its construction, be reversible; that is to say, must be capable of running either backwards or forwards. The position and velocity of every element at any instant must also be absolutely determined by the positions and velocities at the *immediately preceding* instant.

The mechanical representation, even of the simplest phenomena of inanimate nature, is found to be inadequate; for no natural phenomena are found to be completely reversible, or capable of complete specification at any instant in terms of the immediately preceding conditions, without reference to the earlier history of the bodies concerned.

The representation of the whole universe as a mechanism is therefore necessarily an inadequate one, and the necessity of a second model is indicated.

THE universe in which we live and move and have our being does not consist of disconnected elements which we can isolate and examine separately. The smallest change in any part of it is felt throughout the whole. We cannot, however, unravel the secrets of nature by simply regarding it in its entirety, for such a view merely overwhelms us. The only method which we can adopt is to replace the universe that is

by a comparatively simple model representing certain aspects only, and then gradually to increase the number of aspects included by increasing the complexity of the model. This model, unlike the real universe, must be capable of division into distinct parts or elements. Moreover, in order that the model may be susceptible of measurement and calculation, it must be built up of a number of similar elements, for the mathematical processes of measurement and calculation are applicable only to groups of similar elements. Our first step in the systematic, or scientific, study of the world must therefore be to transform it, to replace it by a model. We first build up simple models, and then more and more complicated ones; but though these models approach more and more nearly, as they increase in complexity, to the reality of the actual world, they can never be anything more than models, with all the restrictions inherent in that fact. The successive models, or approximations to the representation of a system of the world, which are presented in these pages, are three in number. The first of these will take account of matter only. The second will take account of matter and ether. The third will take account of matter, ether, and mind.

The initial step in building up the first world-model was made by Archimedes in the third century B.C., who, in his study of the nature of the pressure of liquids, regarded the pressure due to a quantity of liquid as compounded of the pressures arising from a number of similar small portions into which he imagined the whole quantity to be divided. This is, I believe, the first recorded case of the representation of a natural phenomenon by means of a model constructed of elements, which, for the purpose of the problem under consideration, could be regarded as similar. This made mathematical physics possible; for mathematics deals only with combinations of similar elements, and can deal with nothing else.

The earlier mathematical methods were, like that of Euclid, entirely synthetic. They consisted in building up models, from elements assumed to start with, forming representations of the natural phenomena under consideration. The connexions between the parts of the models then served as representations of the connexions between the actual phenomena. These methods required great mathematical insight, both in selecting suitable elements and in devising appropriate constructive processes, a new process being required for the solution of almost every fresh problem. They served, however, for the solution of the comparatively simple problems which presented themselves to the earlier physicists.

Modern physics may be considered as deriving its origin from Galileo's experimental determination of the relation between the velocity acquired by a falling body and the time occupied in the fall, and from the determination by Huygens of the relation between the velocity and the distance fallen through. The former led to the concept of acceleration, which was first definitely formulated by Sir Isaac Newton; while the latter led to the concepts of work and energy. Newton determined the direction of the development of dynamics, or mechanics, by following the line suggested by Galileo's experiments, and formulating his famous *Laws of Motion*, in terms of the concepts of time, length, and mass, assumed as fundamental, and of the derived concepts of acceleration, momentum, and force. A new mathematical method was developed independently by Newton and Leibnitz for dealing with continuously changing quantities, such as velocities and accelerations. Their methods were still synthetic, and although these great thinkers used them most effectively, they were not capable, even in their strong hands, of application to any but comparatively simple problems.

Newton made the first step towards the application

of mechanics to the investigation of the motions of the heavenly bodies by means of the assumption, or guess, that the moon might be considered as a body always falling towards the earth, but always carried beyond the latter, owing to the tendency to conserve the direction and amount of its motion, as observed in the case of bodies near the earth's surface. The assumption that the moon might be treated in this way as a falling body, obeying the laws observed to hold good for those falling bodies which could be handled and experimented with, was found to be justified, provided the earth and moon attracted each other, or were drawn together, with a force varying inversely as the square of the distance between their centres.[1] The experiments with falling bodies had shown, moreover, that the pull exerted by the earth on a body near its surface was proportional to the mass of the falling body; by extending this to the case of any two heavenly bodies, the law of gravitation was formulated in the statement that *two heavenly bodies attract each other with a force varying directly as the product of their masses, and inversely as the square of the distance between their centres.* The extension of the law of gravitation to every pair of particles in the universe, even when the particles formed portions of the same solid body, was, in the first place, simply a bold guess, or hypothesis, which was found to be justified by comparison of the results derived from it with the results of observation.

In this manner the work of those three great physicists, Galileo, Huygens, and Newton, enabled the science of mechanics to be based upon laws which were simply the formulation of observed results, in place of attempting to deduce mechanical propositions

[1] The meaning of a force varying inversely as the square of the distance is, that if the distances increased in the proportion of the numbers 1, 2, 3, 4, the force would decrease in the proportion of the numbers 1, $\frac{1}{4}$, $\frac{1}{9}$, $\frac{1}{16}$.

from the assumed intentions of the Creator. They therefore disentangled physics from theology, to the great and manifest advantage of both.

It is only comparatively recently that the great mathematicians Riemann, Lobachewsky, Cantor, and Peano, have effected a similar disentanglement of mathematics from physics; for B. Russell[1] has shown that the results obtained by them lead to the conclusion that the whole of pure mathematics, including geometry, analysis, and abstract dynamics, can be derived from arithmetical considerations, and is therefore simply an elaboration of formal logic, simply a mental product, or thought-machine, absolutely independent of observation. The importance of this will appear later.[2]

The synthetic thought processes embodied in the mathematical methods of Newton and Leibnitz were sufficient for tracing out the time relations between the successive positions of a moving particle, or the space relations between the simultaneous positions of similar particles in a homogeneous body.

Attempts to adapt mechanics to treatment by the far more powerful analytical methods of mathematics were made by Euler and MacLaurin, and on the foundations so laid Lagrange erected, in 1788, his system of analytical mechanics, an edifice of imposing grandeur and beauty, which forms the basis of all modern mathematical physics. It will not be necessary, for our present purpose, to enter into any detailed consideration of the two mathematical methods, the synthetic and the analytic. It is, however, of the utmost importance for us to understand the general nature of the mathematical thought-process in its application to the representation of the universe of which we form a part, and which shows

[1] *Principles of Mathematics*, vol. i.
[2] See *Problem of the Universe*, p. 76.

this universe to be, not a mere heterogeneous collection of disconnected phenomena, but an ordered system. Any expectation of its ever being comprehended in its totality by the human mind would be the most childish folly; yet every advance of science affords fresh evidence of its intelligibility. The book of nature is, indeed, an awe-inspiring volume, and of all its wondrous aspects, the one which has always appeared to me the most wonderful is its intelligibility to the human mind, which would appear utterly inexplicable were not the universe instinct with the purpose of "an intelligence akin to our own", to use the words of my old friend and teacher, Professor W. K. Clifford. They are to be found in the second number of *The Nineteenth Century*, and the passage, which was written in reference to Dr. Martineau's theistic argument based upon the existence of moral law and the evidence of design in nature, is well worthy of reproduction:

"I fully admit that the theistic hypothesis, so grounded, and considered apart from objections elsewhere arising, is a reasonable hypothesis and an explanation of the facts. The idea of an external conscious being is unavoidably suggested, as it seems to me, by the categorical imperative of the moral sense; and, moreover, in a way quite independent, by the aspect of nature, which seems to answer our questionings with an intelligence akin to our own."

Sir Isaac Newton declared, in the *Scholia* to the *Principia*, that the existence of a Being endowed with intelligence and wisdom is a necessary inference from a study of celestial mechanics, and that to treat of God is therefore a part of Natural Philosophy. He who would be an atheist to-day must either ignore dynamics altogether or beat with feeble hands against the massive foundation-stones of dynamics, which have never been shaken since they were laid in position by the greatest of natural philosophers. The material of these foundation-stones was derived from the

scientifically correlated observations and experiments[1] of Galileo and Huygens, supplemented by those of Newton, but it was the unapproachable genius of the last which fashioned them and laid them in position. It is upon these foundations that the whole structure commonly known as the *Mechanical Theory of the World* has been erected. None of its greater builders ever presented it as even a possibly complete theory in itself. Its development, however, at the hands of Laplace and others, converted it into a model of nature so extensive that inferior thinkers began to believe it capable of affording a complete representation of nature as it is known to us. Its greater builders, on the other hand, were always perfectly aware that it could never be anything more than a model, an approximation, to a complete theory of the world. This is true of every scientific theory, although this very elementary fact appears to be quite unknown to a large proportion of the popular writers who love to describe themselves by the detestable name of *scientists*,[2] and who provide the multitude with the loose and slipshod abortions which pass muster as popular science.

In order to avoid any misconception, I prefer to describe the mechanical world-conception as the *mechanical model* of the universe. We may also call it the *first model*, since it constitutes the first approximation to the complete representation towards which we are ever approaching, but which must ever remain unattainable.

The mechanical, or first, model of the universe was constructed on the basis of Newton's law of gravitation, all the gravitating matter of the universe being regarded as consisting of elements which attracted each other according to that law. Each of these

[1] An experiment is simply an observation under prearranged conditions.

[2] A man of science would no more call himself a *scientist* than a gentleman would call himself a *gent*.

elements, or particles, was therefore regarded as simply a centre of attractive force varying according to this law. This makes it quite clear that Newton's law is simply a model affording a general representation of gravitational action which could be applied to correlating, that is to say, connecting together, many apparently diverse phenomena.

The form in which the law of gravitation was enunciated by Newton naturally led to the expression of the conditions of equilibrium and of motion of bodies and systems of bodies in terms of forces acting at a distance between their component particles; that is to say, to a mechanical model expressed in terms of systems of central forces. Newton himself, the great architect of this system, never regarded the central force system as anything more than a first approximation towards a complete system of dynamics. He made it perfectly clear in his writings that such a system could not afford a fully satisfying representation of natural phenomena, owing to the impossibility of conceiving the action of a body where it is not. The conception of the direct action of one body upon another body at a distance could therefore never provide anything more than a convenient representation. The nature of the actions could be expressed only in terms of a space-filling medium by which they must be transmitted; but no satisfactory conception of such a medium was then available, and Newton did not apparently allow the search for one to divert him from the elaboration of the central force model of mechanics, the branch of physics concerned with the motions and the equilibrium of bodies.

When the first attempt was made to frame a theory of electric and magnetic phenomena, the great success of the central force model in correlating mechanical phenomena led naturally to the construction of a system on similar lines. Electric attractions and repulsions were, accordingly, assumed to be due to central forces,

similar to gravitational forces, and acting between particles of "electric matter", which was assumed to possess the properties requisite to account for the phenomena actually observed. Magnetic phenomena were represented, in a similar matter, in terms of distributions of "magnetic matter". In the hands of Cavendish, Coulomb, Poisson, and others, a very complete scheme was developed on these lines, embracing all then known electrostatic phenomena, and a considerable range of magnetic phenomena. Ampère then formulated a theory of the interaction of electric currents, founded on the assumption of the existence of a repulsion or attraction, according to circumstances, following the same law of distance as the law of gravitation, between every pair of elements of a system of currents. This theory gave rise to complicated and artificial-looking expressions for the mutual actions in hypothetical unclosed circuits; but the observed mutual actions of closed circuits, which alone could be experimentally verified, were in complete agreement with the results of Ampère's theory. Moreover, with the further extensions due to Weber, Neumann, and others, the central force system provided a satisfactory representation of a very wide range of phenomena, including the representation of magnetic effects in terms of molecular electric currents. It was shown, further, by Lord Kelvin and von Helmholtz, that Faraday's great discovery of electromagnetic induction might have been anticipated from this theory, and by Kirchhoff that it would account for the propagation of electric waves of short periods along metallic wires with a velocity nearly equal to that of light. In fact, this theory accounted for the whole range of electric and magnetic phenomena then known, and might have been employed to predict others discovered subsequently. It is true that Weber's theory was adversely criticized by von Helmholtz on general dynamical considerations, but

his arguments really showed only that the theory would lead to impossible results in the case of velocities, or vibration frequencies, approaching those of light—conditions of which there was no experimental evidence prior to Hertz's researches on the electric waves now employed in wireless telegraphy, and these researches were made in 1888, many years after von Helmholtz's criticisms.

The fact that so comprehensive a theory should eventually have to be discarded in favour of a still more comprehensive one is striking and noteworthy, but it is by no means an isolated case. The whole path of progress in physical science is strewn with theories which have served their purpose, and served it well, by leading the way to their own replacement by more perfect ones, which will in all probability have to give way in their turn; and I have already pointed out how these discarded theories may be revived in the form of superstitions, and employed to mislead the uninformed, whose notions of science are derived from the incompetent popularizers of various branches of science who seek to hide the paucity of their knowledge by the positiveness and comprehensiveness of their assertions.

In the Newtonian system of mechanics the concept of work is derived from that of force, the work done by a force being measured by the product of the force into the displacement of its point of application in the direction of the force. The concept of energy is then derived from that of work, energy being conceived as capacity of doing work. The energy of a system is therefore measured by the amount of work which would be derived from it if it were possible completely to exhaust its energy; that is to say, to abstract the whole of its energy.

If the science of mechanics had been based upon the relation between the velocity acquired by a body falling under the action of gravity and the distance

fallen through, as determined by the experiments of Huygens, the concepts of work and energy would, as already pointed out, have appeared at an earlier stage, and the force acting upon a moving body would have been defined as the rate of increase of its energy of motion.

Let m be the mass of a falling body, t the time of fall, s the distance fallen through, v the velocity gained, and g the value of the acceleration of gravity; that is to say, the gravitational force acting upon unit mass on or near the earth's surface.

Then the relation obtained by Galileo is represented by the equation $gt = v$, or $mgt = mv$, expressing the fact that the product of the gravitational force acting on the body by the time of fall is equal to the momentum gained. The relation obtained by Huygens is represented by the equation $gs = \frac{1}{2} mv^2$, expressing the fact that the work done by the falling body is equal to the energy of motion gained. Both are equally fundamental expressions of actual experience, and both are therefore equally well fitted to form the starting-point of a system of mechanics. Now that all the concepts involved, and their mutual relations, are thoroughly familiar, even to the elementary student of mechanics, this appears so obvious as to make it superfluous to call special attention to it. Nevertheless, the principle of work, as conceived by Huygens, was received by his contemporaries with almost universal distrust, and whenever its convenience led to its employment, the attempt was made to replace the direct deductions from it by arguments based on the more familiar Newtonian principles.

The Newtonian principles are certainly more simple of apprehension, but many physical problems which would be quite insoluble by the Newtonian method, on account of the laborious attention to details involved in its application, are found capable of simple solution by aid of the Huygenian principle of work.

The result arrived at experimentally by Huygens, expressed in terms of our present conceptions by the statement that the energy of motion gained by a falling body is equivalent in amount to the work done by the body during its fall, is not strictly correct for bodies falling in air, but only for bodies falling in vacuo. The work done by a body falling in air is, as we now know, greater than the energy acquired by the falling body by the small amount required to overcome the frictional resistance of the air.

The experiments of Sir Benjamin Thompson, better known by his Austrian title of Count Rumford, on the production of heat in boring guns and in other cases of friction, confirmed by Sir Humphrey Davy's experiment of melting two pieces of ice by rubbing them together in vacuo, showed that the work absorbed in overcoming frictional resistance reappeared in the form of heat. Until this time, the dawn of the nineteenth century, heat had been regarded as some kind of imponderable matter which could be extracted from bodies by friction or percussion or, in the terminology of the period, could be transformed from *latent* into *sensible* heat. Sir Humphrey Davy's experiment showed that the heat was actually generated from, and not merely rendered sensible by, the mechanical work of friction. Some forty years afterwards, Mayer, and a couple of years later, Joule, actually determined the *mechanical equivalent of heat*, the numerical ratio of the number of thermal units produced to the number of units of mechanical work expended in their production, and so provided an experimental basis for that great generalization of modern physics, the principle of the *conservation of energy*, according to which energy is, within the limits of our experience, indestructible, so that when it disappears in one form, it invariably reappears without loss in another form. This principle was formulated, as an experimental

generalization, by von Helmholtz shortly after, and on the basis of, the determinations of Mayer and Joule. It had, however, though unknown to Helmholtz, been stated in definite terms by George Green in 1837, but simply as a probable assumption, and not upon any experimental basis. It is, further, implicitly involved in the denial of the possibility of perpetual motion, which was the principle assumed by Stevinus in the sixteenth century as the basis of his investigation of the equilibrium of bodies resting upon an inclined plane, from which, again, he deduced the conditions of equilibrium of levers and pulleys. The principle of the conservation of energy is, further, implicitly involved in the Newtonian system of dynamics, which forms the basis of the mechanical model, or as I have also called it, the first model, of the universe. If, therefore, the universe were capable of completely adequate expression in terms of this first model, in other words, in mechanical terms, the principle of the conservation of energy would necessarily be rigorously applicable to the whole universe as we know it. Even if the universe appeared to be capable of such representation, we could never be absolutely certain of it, and therefore the principle of conservation of energy could not possibly have any greater certainty than the experimentally determined laws of dynamics which form the basis of the first model. The statement made by Prof. Haeckel in chapter xii of *The Riddle of the Universe*, that this principle is "a necessary consequence of the principle of causality", in addition to being a philosophical absurdity, proves conclusively that he has never grasped the elementary fact that all physical science rests upon the foundations of observation and experiment.

Any system consisting entirely of masses of sensible size, and either moving relatively to one another or retaining their relative positions unchanged, is a mechanical system in its most general form, for

masses at rest or in motion are the only elements employed in building up the mechanical model which we have been considering, and unless the masses were of sensible size we should have no means of ascertaining their relative amounts or positions. The energy of such a system can be completely expressed in terms of mechanical units of work; for example, it can be measured by the product of a given mass by the height to which it could be lifted against the force of gravity at a given point on the earth's surface by the expenditure of the whole of the energy. The necessity for specifying a fixed point arises from the fact that the force of gravity varies from point to point of the earth's surface. Part of the energy of such a system at any given moment arises from the relative positions of the masses at that moment, and is called *potential energy*. The remainder arises from the motions of the masses, and is called *kinetic energy*. It is found, as a matter of observation, that the whole energy of such a system, provided it be possible to control it completely, can be converted into heat. The reconversion of the whole of this heat into mechanical work is, however, found to be absolutely impossible; for it is a universally observed fact that, in every transformation of heat into mechanical work, the heat is found to be derived from a hotter body, and that, in the process of transformation, some of the heat so derived is invariably found to be transferred to a colder body, which is actually heated thereby. Some of the original heat, therefore, instead of being converted into mechanical work, simply falls in temperature. It thereby becomes less available for transformation into mechanical work; for such further transformation could only be effected by allowing this low temperature heat to fall to a still lower temperature by transferring the portion not converted into work to a still colder body.

The result of this is that any isolated system,

although retaining the whole amount of its energy unchanged, in accordance with the principle of the conservation of energy, will tend, of its own accord—that is to say, without the application of any external force—to pass through transformations which will diminish the availability of the energy for the performance of useful work. For, since work is done only when a transformation of energy occurs, every change undergone by the system of its own accord, and in which, therefore, any work done is unutilized, diminishes its capacity for doing useful work. This tendency of the energy pertaining to every system of bodies which we are able to observe, to pass from a form in which it is available for doing mechanical work to a form in which it is unavailable, is known as the principle of the *dissipation of energy*. It was first recognized and pointed out by Lord Kelvin in 1852.

This discovery of irreversible phenomena in nature showed that the mechanical model could not possibly provide a complete representation of natural phenomena. Every change in the mechanical model is reversible by the simple process of reversing the direction of motion of each one of the constituent sensible masses at any given instant. The system will then retrace all its past changes in the reverse order to that in which they originally followed each other. The observed dissipation of energy makes such a reversal impossible in the case of any known natural system, and shows that the mechanical model is only a first model, a first approximation towards the representation of the observed phenomena of nature.

Lord Kelvin pointed out, further, that the dissipation of energy observed in all natural systems accessible to observation, led to the conclusion that the universe must have had a beginning in time, that it could not be an eternally self-existing system. At the moment of this beginning, the availability of the energy of the universe for the production of mechanical work,

must have been greater than at any subsequent time, and must be continually diminishing. Moreover, this process cannot continue for ever. The available energy must ultimately become exhausted by its final transformation into uniformly distributed heat at a very low temperature. Such a condition might be described as *physical death*, for there would no longer be any visible motion or sensible change of any kind in any part of the universe. Further, the initial state of things could not be brought about by any physical means known to science, for under all known conditions the availability of the energy tends to decrease—never to increase. The beginning must therefore have been brought about by a power of a kind unknown to physical science. The origin of the universe would be unaccountable in the absence of creative power.

Some physicists have argued, quite legitimately, that our experience extends only to a comparatively small portion even of the visible universe, and that it is conceivable that the physical conditions in distant portions, inaccessible to observation, may be altogether different, and of a kind entirely unknown to us, and that we are therefore not justified in making inferences about the whole of the universe from our experience of a small portion of it.

Many writers of magazine articles and books on popular science have, from simple want of knowledge, interpreted such arguments as discrediting Lord Kelvin's conclusions. Not only every man of science, of whom Lord Kelvin was one of the greatest, but every properly trained student of science, is perfectly aware of the limitations of all our conclusions regarding distant portions of the universe, and also regarding the past and the future even of the portions known to us. All such conclusions admittedly rest on the assumption that the laws of nature are the same in distant portions of the universe, and at distant times,

as they are found to be in our experience here and now. To suppose for one moment that Lord Kelvin was unaware of these limitations is mere childish ignorance utterly incompatible with any knowledge of his scientific work, or with the knowledge requisite for intelligently studying the record of it. Such ignorance is, however, unfortunately characteristic of many writers who are popularly regarded as scientific authorities.

No advance in science can ever, by any possibility, remove these limitations. What it can do, and always is doing, is to extend the area of our experience; and we shall presently see that the truth of Lord Kelvin's conclusions are confirmed by our experience of the whole visible universe as revealed by the most powerful instruments available to the astronomer, extended over the period of time occupied by light in travelling, at the speed of 186,000 miles per second, from the most distant stars to the earth.

In the case of a star of the twentieth magnitude, just perceptible by the most powerful telescopes, this period would be about twenty-eight million billion years. The diameter of a sphere containing all the stars down to the twentieth magnitude would therefore be about fifty-six million billion light-years, the term light-year being used to represent the distance traversed by light in a year.

The insufficiency of the mechanical model may also be demonstrated by means of a very simple experiment to the many who will find it difficult to grasp the somewhat recondite phenomenon of the dissipation of energy. A very little reflection will make it clear that the state of a mechanical model at any instant can depend only on its immediately preceding state. It cannot depend on the manner in which this preceding state was arrived at. That is to say, it cannot depend on the previous history of the model.

Now take a glass fibre to one end of which a weight

is attached, while the other end is attached to a fixed support. Below the weight place a watch with the dial upwards, attach a long light horizontal pointer to the weight, and twist it through a small angle measured in the same direction as that of the motion of the hands. In other words, give a small clockwise twist to the weight, and then let it go, and watch the pointer. This will at first vibrate backwards and forwards a few times, and will then apparently come to rest. If, however, we continue to watch the pointer, we shall see that it is turning very slowly in a counter-clockwise direction. The fibre is gradually untwisting.

Now twist the fibre several times in succession alternately in each direction, through angles of varying magnitude, noting the magnitude and direction of each twist, and the order in which they are made. If the pointer be again watched patiently for a considerable time, the successive twists will be seen to come out of the fibre in the reverse order to that in which they were put in. That is to say, the state of the fibre at any instant is not wholly determined by the immediately preceding state, but depends also on its past history, the order in which the twists were put in.

It follows therefore that even so simple a system as a glass fibre with one end fixed, and carrying a weight at the other, cannot be completely represented by a mechanical model.

The necessity of a second model is therefore indicated, and this will form the subject of the next chapter.

CHAPTER III

THE ENERGY WORLD-MODEL, OBTAINED IN THE FORM OF AN ELECTRON WORLD-MODEL

SUMMARY

The structural elements of the energy-model are : the conception of the molecule by John Dalton as the result of his chemical researches : the conception of a space-filling medium, the ether, serving for the transmission of the interactions of the molecules.

The change from the separately distinguishable elements of the mechanical model to elements of which aggregates only are accessible to observation necessitates a change in the mathematical methods employed, and we are thereby compelled to abandon the concept of linearly related chains of cause and effect, and to recognize the system of nature, even within the limitations of the energy-model, as being, not a more or less discrete aggregate, but a completely interrelated system, or process, from which no smallest part can be abstracted without effecting a modification in the whole.

The experimental achievements of a great body of scientific workers, and the corresponding development of ether theory providing for their adequate and consistent expression, have led, through the conception and experimental isolation of the electron, to the elimination of the duality between ether and matter, and to the expression of both in terms of energy as a common basis of the observed phenomena of inanimate nature.

This development, to which the discovery of radium and its congeners has largely contributed, has shown that the energy world-model affords an adequate representation of inanimate nature as at present known.

Experience extending throughout the whole visible universe, and over an unimaginably vast period of time, shows that the activities included in the scope of the energy world-model are incapable of accounting either for the origin in time of the inanimate visible universe or for the only possible alternative, its eternal existence.

The second model, in common with the first, has, moreover, been found incapable of accounting either for the phenomena of life, as at present existing, or for the origin of life.

The necessity of a third model is therefore indicated, and this

necessity is a consequence of the conclusion that the observed phenomena of inanimate nature are capable of adequate expression in terms of energy changes alone. No living physicist would question the validity of this conclusion, which would be in no way affected if the concepts of the electron theory, and even the concept of the ether, were to be displaced by the future development of a representation even more satisfactory than the one here set forth.

THE insufficiency of the mechanical world-model shows the necessity of a second model, but does not by any means involve the abandonment of the earlier one, which has been of such great assistance in our exploration into the nature of the universe of which we form a part. The growth of knowledge, like every other kind of growth observed in the system of nature, proceeds, not by sudden bounds, but by continuous development or evolution. The insight into nature which has actually been achieved by aid of the mechanical model shows that, in its more superficial aspects, the universe may be regarded as a mechanism, and all the earlier work on the second model was carried out on the very same lines which had led to the development of the first model. It consisted, in fact, of constructing models within the original model. The mechanical model was accepted as representing the outlines or framework of nature, and the further development consisted in building up secondary models to represent, in the first place, the internal structure of each portion of the framework, and in the second place, the links connecting all these separate structures into a consistent whole.

The first of these two processes necessarily led to an ever-increasing specialization of scientific research, until, in the earlier portion of the nineteenth century, the whole field of scientific knowledge appeared to be divided into distinct sections, separated by impenetrable boundary walls. The second process, which involved the breaking down of these boundaries, was initiated by the two great physicists Hermann von

Helmholtz and Lord Kelvin, and carried out by means of the principle of the "conservation of energy".

The first step in constructing a model to represent the internal constitution of the material particles of appreciable size which formed the ultimate elements of the first model was to make the hypothesis, or guess, that these particles were built up of smaller ones. This hypothesis was verified by the work of the great chemist John Dalton, who, in the first few years of the nineteenth century, established the atomic theory of the constitution of matter on an experimental basis. His investigations showed that the innumerable kinds of matter familiar to us are composed of various groups, formed by combinations of a comparatively small number of distinct kinds of particles. The smallest group of which the repetition in sufficient numbers would give rise to a perceptible quantity of substance was called a molecule. The separate particles of the group forming a molecule were called atoms, because it was found to be impossible to observe or effect, by any methods then known, any further subdivision of them. The word atom never meant anything more than this to the scientific physicist, though he might speculate on the question of whether further subdivision might or might not be a possibility in the future.

This possibility has now been realized, as we shall presently see, and therefore to the physicist of to-day an atom means no more than a particle which does not undergo chemically perceptible subdivision, which would be indicated by a complete change of type during chemical reactions. The atomic theory still forms the basis of chemistry, although we now know that the atoms can, in some cases, be further subdivided by the use of appropriate methods. This is, therefore, not an instance of the subversion of an established theory by the progress of scientific knowledge. The only subversion was that of the speculative

hypothesis that an atom might be an ultimate particle incapable of subdivision. It is quite true that many popular writers with a smattering of scientific knowledge failed to distinguish between the established scientific theory and this speculative hypothesis; but this is the way of the smatterer. No statement is too wild for him to make, or for his ignorant and credulous hearers or readers to accept. I have known such an one, in a work which claimed to be critical, to assert that "from end to end of the universe" no evidence existed for the truth of a proposition from which he had been taught to dissent. He did not pause to reflect that such an assertion amounted to a claim that the universe had been explored by him, and was completely known to him "from end to end", to employ his own very inadequate expression.

The atomic theory of matter would have been of little or no assistance in investigating the structure of the various elements of the mechanical model, had physicists been confined to the Newtonian mathematical methods. The individual atoms and molecules are far too small to be distinguished by the highest powers of the microscope, so that there would be no possibility of following and mapping out their motions in detail. Lagrange's wonderful system of analytical mechanics provided, however, exactly the instrument required. The position of a point, and therefore of a material particle in space, can be specified by means of three quantities. For example, the position of the centre of the moon relatively to that of the earth at any moment could be determined by the distance between the centres, and the latitude and longitude of the point at which the straight line joining their centres intersected the earth's surface. It could also be determined by the distances of the centre of the moon from three planes intersecting each other at right angles at the centre of the earth. Either of these sets of three quantities would be called the

co-ordinates of the moon's centre with regard to that of the earth, taken as *origin* of the system of co-ordinates selected.

Lagrange's method made it possible to determine completely the motion of a system of material particles whose co-ordinates and masses are known, by means of a set of equations, that is to say, of relations between the co-ordinates and the momenta, or products of mass by acceleration, of each of the particles. Moreover, the method was of such a character that any quantities connected with the system, whatever their nature, could be taken as the co-ordinates. If, therefore, a sufficient number of such quantities could be determined, the motion could be determined for all time. Further, if it were possible to determine only a smaller number than was requisite for the complete specification of the system, Lagrange's method would, provided all mathematical difficulties could be overcome, supply all the information about the system which it would be possible to obtain from the known data. This it is which enables us to make use of the atomic theory in dynamical investigations.

It would obviously be impossible to determine the co-ordinates of the individual molecules, and the only available method is to determine, from observations on the matter in bulk, the average effects due to the motions of the molecules. It can be shown that the result of this is that the existence of any one solution of a problem in molecular physics necessarily involves the possibility of an infinite number of other solutions. It is therefore impossible, in problems of molecular physics, to obtain the unique solutions which are obtainable in mechanical problems.

The Lagrangian methods, and their more modern developments, owe their great generality to their being derived from the Huygens principle of work which, in its generalized form, is simply the principle of the conservation of energy.

In the Newtonian synthetic method we build up a model in detail until it approximates as closely as possible to the system under consideration, a process which is feasible only in the case of very simple mechanical problems. The more general analytic Lagrangian method, on the other hand, may be represented as the casting of an immense net into the limitless depths of the universe, taking in all space and all past and future time, the construction of the net being such that, as we draw it in, it will allow to slip through its meshes everything which does not sensibly affect the problem we are attacking, and everything else with which the data at our disposal are insufficient to deal, and deliver the remainder into our hands, not as a confused mass, but as an ordered solution of the problem, as complete as it can possibly be made from the data which we have been able to determine by observation. But the casting and drawing in of the net are no simple processes. It requires long years of severe training even to understand the method of its manipulation; and to cast it effectually into the fathomless depths, and to draw thereout solutions of the hidden secrets of nature, demands, not only severe training, but that insight which Tyndall called the scientific imagination. It would, in my opinion, be more correctly described as intuition, and I have endeavoured, in chapters iv and v, to trace it to its source. At present I will therefore merely ask the reader to ponder for a moment on the significance of this power of the human mind, aided by the most wonderful of all the products of human reason, the elaborated thought-process of mathematical analysis, thus to project itself into the profound depths of the universe, into the fathomless abysses of space and time, to search them out and unveil their deepest secrets. Would such results be conceivable in a universe of anarchy and disorder arising from the mere purposeless clashing of countless myriads of

atoms? To a mind capable of asking itself such a question, with any apprehension whatever of its meaning, the question is answered in the asking. The intelligibility of the universe to the mind of man is in itself an irrefutable proof of its pervasion by mind to which the mind of man is akin, and completely establishes the truth of the statement by the ancient seer that God created man in his own image.

The problems now presented are of infinite complexity in comparison with those dealt with in the mechanical model. We can no longer isolate any phenomenon and trace its origin to a specific cause, or group of causes. We can effect only a partial isolation which involves a transformation, not merely in the system of nature, but in the simplified model itself. We find that the representation of this partially isolated phenomenon as arising from a single cause, or from a group of causes, is only a first step in the building of a portion of the model, and as we succeed in making further steps, or approximations, it gradually dawns upon us that if we could complete the process, we should find that the cause of the phenomenon upon which our attention is concentrated can be nothing less than the whole complex of the ideally completed model. We are therefore compelled to abandon the old Aristotelian concept of a chain of causality, with all the inferences drawn from it, and to recognize that, even within the limits of the energy-model, the system of nature must be regarded, not as a more or less discrete aggregate, but as a completely interrelated and interconnected system or process, from which no smallest part can be abstracted without effecting a modification in the whole, and which cannot therefore be dissected into chains or series related singly to one another as cause and effect respectively.

We might now take the atomic nature of matter as a fact deduced from observation and experiment, and then proceed to ask ourselves the question: How

can these atoms be linked together so as to be capable of the interactions which we observe between them? We should then find ourselves compelled to assume the existence of a *plenum*, or medium completely occupying the intervening spaces, and transmitting the strains and motions determined by the atomic nuclei. The first step to be made would be to assign a suitable system of properties to the medium. The most direct method of attacking this problem would be to formulate, by the methods of Lagrange, a system of equations expressing the properties of the medium in terms of as large a body as possible of known phenomena. The validity and completeness of the system would then have to be tested by comparing it with any phenomena which had not been taken into account in its construction, and such extensions and modifications as might be found necessary would have to be made. If this process could be continued until all known phenomena in which the medium is concerned were included, the resulting system of equations would define its properties as completely as possible in the existing state of knowledge. This medium is known as *the ether*.

We might then attempt to increase our knowledge by developing the system mathematically until new phenomena were indicated, and devise experimental methods of sufficient delicacy to determine whether the phenomena predicted by the equations were or were not actually existent. In the former case we should obtain further confirmation of the adequacy of our system of equations. In the latter, a flaw would be indicated, and would have to be remedied by making the necessary modifications in the system. Such a course is frequently arrested by mathematical difficulties which make it impossible, in the existing state of mathematical knowledge, to continue the development in the most general form. The mathematical physicist then casts about for likely hypothe-

tical assumptions, which he will follow up as long as they lead to results which are confirmed by experimental research, but will abandon whenever they conflict with it.

Most of the recent advances in our knowledge of the nature of the ether and of its relations to matter have been made in this manner, but the earlier ideas of the ether were arrived at by the far easier, though more circuitous, synthetic methods. The first step in the synthetic method would be to assign to the ether a set of properties which would enable it to account for the simpler and more obvious observed phenomena, and the second step would be to ascertain the results which would follow from the ascription of these properties to the ether, and to compare them with other observed phenomena. If the results were accordant it would so far confirm the validity of the initial assumptions, while any discrepancies would necessitate their modification, and again testing by observation.

Huygens was the first physicist to propound an ether with a consistent set of properties which would give it an elasticity capable of transmitting the regular waves which he assumed as the physical basis of the phenomena of light, and by its means he succeeded in accounting for the reflection and refraction of light.

The ether does not manifest itself directly to our senses, but only through the intervention of matter. It does not, like matter, oppose any sensible resistance to our movements. Again, the speed with which light traverses transparent bodies, though less, as we now know, than its speed in ether free from matter, is far too great to be transmitted by the matter itself. Sound waves are transmitted by the matter of solid, liquid, and gaseous bodies, and their speed is greater the greater the ratio of the elasticity of the substance to its density, a ratio which, within certain limits,

usually increases with the temperature. In air at 20° Centigrade, which corresponds to 68° Fahrenheit, the speed is about 1,100 feet per second. In sea water at the same temperature it is about 4,760; in lead about 4,030, and in iron about 16,800.

Huygens's *Traité de la Lumière* was published in 1690, and all that was then known with regard to the velocity of light was derived from Römer's observations on the apparent retardation and acceleration of the eclipses of Jupiter's satellites when Jupiter and the Earth were on opposite sides, and on the same side, of the Sun, respectively. Römer had, in 1676, deduced from these observations the conclusion that light takes 16½ minutes to traverse a distance equal to the mean diameter of the earth's orbit, i.e. travels at the rate of 186,500 miles per second, a figure which exceeds the most recent determinations of the velocity of light by less than 200 miles per second. This was, however, quite sufficient to show that the ratio of the elasticity of the ether to its density must enormously exceed that of any known material substance, and, consequently, that the passage of light through transparent bodies could not be transmitted by vibrations of the material particles, but must be transmitted by the ether in the interior of matter as well as in space. Every body capable of transmitting light, even in the smallest degree, must therefore be permeated by the ether. It was natural to assume that a medium capable of freely permeating all bodies, and which offers no perceptible resistance to their motion through it, must be a fluid, and moreover that it must be almost or completely frictionless. The assumption made by Huygens was that the ether was a completely frictionless fluid, or what the mathematician calls a perfect fluid.

Now a perfect fluid offers no resistance, and actual material fluids offer no permanent resistance, to deformation. They can permanently offer resistance to

compression only; they have no rigidity, or resistance to *shearing*; that is to say, to the sliding of one part of the medium over another. Now a wave in which the direction of motion of the medium is transverse to the direction in which the wave is travelling can be transmitted only through a medium which possesses rigidity. A fluid, whether liquid or gaseous, can transmit only waves in which the direction of motion of the medium is identical with the direction of transmission. Vibrations of the latter kind are known as longitudinal vibrations.

Huygens succeeded in accounting, by his ether hypothesis, for the reflection of light, and its simple refraction. By means of the additional assumption of a varying elasticity of the ether in different directions in doubly refracting crystals he was also able to account for the phenomenon of double refraction, as observed, for example, in Iceland spar. Yet it was discovered later that the vibrations constituting light-waves are not longitudinal, but are entirely transverse to the direction of propagation.

Newton was fully convinced of the necessity for the existence of some such medium as the ether for the explanation of all physical actions between distant bodies, such, for example, as gravitation. He was, however, prevented from accepting the wave theory of light propounded by Huygens owing to the fact that he could not see his way, on this theory, to account for the sharp definition obtainable in the case of light-shadows. He tried to overcome this difficulty by his corpuscular theory of light, according to which light was due to the emission by luminous bodies of minute particles, or corpuscles, moving in the direction of propagation. Later on, Young and Fresnel showed that the rectilinear propagation of light, with its resulting sharply defined shadows, was a consequence of the extremely short wave-lengths of luminous vibrations. If this discovery had been made in

Newton's lifetime, it hardly seems possible to doubt that Newton would have accepted the wave theory and abandoned the corpuscular one. His followers, however, dreaded lest the acceptance of the views of Huygens should lead to a recrudescence of the complex system of ethers of pre-Newton speculative physics, derived directly from the Greek philosophers, who in their turn probably derived them from the speculations of ancient Indian thinkers. These speculative ethers formed a series of sinks for the disposal of every unexplained physical difficulty, and had been swept away by the investigations of Galileo, Huygens, Newton, and others. Professor Haeckel has attempted to reintroduce them in a very crude form derived from a modern, but unscientific, German writer. These fears, combined with the great influence of Newton, led to the retention of the corpuscular theory for nearly a century, and it was abandoned only when comparative measurements of the velocity of light in media of varying density showed that this velocity decreased as the density of the medium increased, which was in accordance with the wave theory, while, according to the corpuscular theory, the velocity should be greater the greater the density.

The discovery by Malus, in 1810, of the phenomenon of the polarization of light, and its communication by him to Fresnel and Arago, led these physicists to make further experimental investigations, and it was the impossibility of accounting for the results on the theory of Huygens which led Fresnel to formulate his hypothesis of an elastic solid ether capable of transmitting transverse waves. The phenomena of polarization showed that the waves must be entirely transverse, and Green, in 1837, showed that the complete absence of longitudinal waves could be accounted for by assuming the Fresnel ether to be practically incompressible. Besides the difficulty of forming a conception of an elastic solid filling all

space and yet offering no appreciable resistance to the passage of the heavenly bodies through it, Fresnel's theory was found to be incapable of accounting for all the optical phenomena then observed except by aid of further assumptions which were inconsistent with each other.

MacCullagh, in 1839, succeeded in obtaining a complete solution of the nature of the elasticity which must be possessed by the ether in order to account satisfactorily for all the optical phenomena then known. Fresnel had found it necessary to regard the density of the ether as varying with the presence or absence of matter and with the density of the latter; MacCullagh's investigation, however, led to the conclusion that the density of the ether is everywhere the same, but that within material bodies its rigidity varies with the nature of the body. The only further property which had to be possessed by the ether was a resistance to any twist of every smallest element of it. Such a medium would offer no resistance to the passage of a material body through it, provided that the passage did not give rise to such twists. MacCullagh was unable to devise anything in the shape of a material model of a medium possessing such unfamiliar properties, which bore no resemblance to those of any known kind of matter, and was therefore compelled to leave the representation of the constitution of his ether in the extremely abstract form in which he first obtained it, viz. a set of differential equations. It could therefore appeal only to mathematicians, and, in consequence, received very little attention until Fitzgerald, in 1880, pointed out that MacCullagh's equations representing the propagation of light were identical with those obtained by Clerk Maxwell for the propagation of electromagnetic disturbances, so that the properties of MacCullagh's ether were those required by the electromagnetic theory of light, to which Maxwell had been led by the

observation that the calculated speed of propagation of an electromagnetic disturbance was identical with the observed speed of propagation of light.

Lord Kelvin, in 1889, showed the possibility of imagining a model, built up of ordinary matter, which is capable of representing, though in very crude form, the property of the MacCullagh ether of elastically resisting twist in any direction. Such a model cannot be anything more than an assistance in forming a mental picture of the scheme of mathematical relations involved, but, as Sir Joseph Larmor has pointed out, the possibility of constructing such a model shows that the MacCullagh ether is a perfectly legitimate dynamical concept. I must, however, warn the reader against entertaining any such supposition as that the resistance of the ether to twist might be due to the presence in it of any kind of material structures. The great majority of physicists at present regard it as at least highly probable that the molecules of matter are structures in the ether, and formed from the ether, and evidence on which this opinion is founded is dealt with later. Whatever the ether may be, it is certainly not a structure built up of matter. Lord Kelvin's model of the ether is arrived at by imagining a medium built up of perfectly smooth spheres, each studded over symmetrically with a small number, say six, of short smooth spikes. This will form a crude, but perfectly conceivable representation of a perfect fluid; that is to say, an absolutely frictionless fluid. The spikes serve to maintain continuity in the motion of the medium, without the aid of viscosity, and they will also compel each sphere to participate in the twist of the portion of the medium containing it. In order to obtain the requisite elastic resistance to twist, Lord Kelvin imagined that each sphere contained three gyroscopic tops, each consisting, as usual, of a heavy disk spinning about an axis through its centre and perpendicular to its plane, this

axis being pivoted within a ring in such manner as to form a diameter of the ring. If three such rings were pivoted within each sphere in such a way that the axes about which they were capable of rotating were in three directions at right angles to each other, while the axis of each ring was at right angles to the axis about which the disk rotated, this result would be attained, and the resistance to twist would be independent of its direction; that is to say, the elasticity would be what is termed isotropic. This would, however, only hold good provided the total displacements of the axes of the gyroscopic tops were small. But this is all that is required in order to confer upon the medium the necessary elastic resistance to twist to enable it to transmit vibrations of small amplitude, corresponding to the luminous and other electromagnetic vibrations transmitted by the ether. There will be no twist in the ether except in the presence of electric force[1], and the high speed of propagation of light and other electromagnetic waves makes it necessary to assume an extremely high elasticity, which will involve a correspondingly high value for the inertia, and consequently for the density of the medium, so that the strongest electric forces would give rise only to very small twists. We shall presently see that this assumption is a legitimate one. It may be represented in the model by employing massive disks spinning with a high velocity. By making the disks sufficiently massive and the velocity of spin sufficiently great it would be possible to represent a field of steady electric force lasting, without sensible decay, for any assigned length of time. It could not, however, be made to last for ever, for such a model can only approximately represent a perfect frictionless fluid. The model therefore, in common with all models, is an imperfect representation. It is, however, sufficient, as Sir Joseph

[1] *Problem of the Universe*, p. 159.

Larmor has pointed out, to show that the equations which determine the nature of the ether, as obtained by MacCullagh from optical, and by Maxwell from electrical data, contain none but perfectly legitimate dynamical concepts. They represent, not a nearly frictionless, but a perfectly frictionless fluid, and so provide a satisfactory basis for the modern view of matter as a structure built up in and from the ether. According to this view of the nature of matter the presence of the smallest trace of friction in the ether would involve the consequence that the whole visible universe would ultimately dissolve into the ether, and every vestige of its existence would disappear.

The first attempt to eliminate the duality between matter and ether was Lord Kelvin's suggestion that material atoms might consist of vortex rings in the ether, similar in character to the smoke rings sometimes blown from the mouth of a smoker or from the funnel of a locomotive. These are formed in the air, the smoke serving only to render them visible; and they soon vanish owing to the viscosity of the air, that is to say, the friction between its particles. Smoke rings may be produced at will by means of very simple apparatus[1], and shown to possess the properties of solids, including elasticity. Mathematical investigation confirms this, and shows that in a perfect fluid such rings could not be produced by any method conceivable to us; and on the other hand, if such rings existed in a perfect fluid, they could not be broken up by any conceivable method. Maxwell objected to this hypothesis that it did not account for the mass, or inertia, of matter. Sir Joseph Larmor subsequently showed that an electric charge could not be communicated to matter so constituted.

Both of these objections to a theory of vortex atoms were obviated by the introduction of the concept of the electron, which has revolutionized our

[1] *Problem of the Universe*, p. 171.

ideas of the nature of both electricity and matter, and led to the development of an electrical theory which is drawing the whole wide range of physical science into its embrace. It is, in fact, taking the form of a master key for the unlocking of the most hidden recesses of inanimate nature, and opening a way through to the still more profound depths which underlie them.

The first step towards the passage of electrical theory from the stage of the first model to that of the second was made by Cavendish in the eighteenth century, and consisted in his discovery of the fact that the nature of the dielectric, that is to say, non-conducting, medium separating a system of conductors plays an important part in the transmission of electric actions between the charged and other conductors. Cavendish's manuscripts containing these investigations, however, remained buried in the archives of the Royal Society until they were unearthed and published by Clerk Maxwell in 1879. The fact was rediscovered by Faraday during the first half of the nineteenth century, and is now the universally accepted basis of modern electrical theory, the foundations of which were laid and much of its superstructure outlined by his profound genius. The ideas were novel and difficult of apprehension, and this difficulty was greatly enhanced by the manner of their presentation. Faraday's theory possessed the complete consistency of a theory developed on rigidly mathematical lines, but Faraday had never received a mathematical training, and so his investigations were not cast in the mathematical mould. The images which he used were therefore entirely novel, and it was only when Maxwell had developed them in mathematical form that their import was thoroughly understood.

The first edition of Maxwell's classical treatise on electricity and magnetism was published in 1873, and he then pointed out that the two laws in which

Faraday had summed up the results of his investigations in electrolysis appeared to indicate a molecular nature for electricity, and suggested that such an assumption might serve provisionally as a convenient working hypothesis. Hermann von Helmholtz, in the course of the Faraday lecture at the Royal Institution in 1881, argued that these laws necessarily led to the conclusion that if the chemical elements were composed of atoms, then electricity, both positive and negative, must also be divided into definite elementary portions behaving like atoms; for the same definite quantity of either positive or negative electricity was found to move always with each *univalent ion*; that is to say, each atom or group of atoms capable of replacing, or combining with, an atom of hydrogen. This definite quantity of electricity was found to accompany the *ion* during all its motions through the interior of an electrolyte, and von Helmholtz suggested that it should be called the electric charge of the atom. Dr. Johnstone Stoney proposed that it should be called an electron, or natural electrical unit.

Some of the luminous phenomena observed in tubes containing only highly rarefied gases (commonly known as vacuum tubes), when traversed by an electric current, led Varley to suggest, in 1871, that in this case the ions actually consisted of electrified particles projected from the negative terminal of the tube, and this suggestion was confirmed by Sir William Crookes's investigations, and he, with a wonderful intuition, which received very little appreciation at the time, designated the conditions of their existence as a *fourth state of matter*, seeing that these swarms of particles differed in their behaviour from that of any one of the three states of matter hitherto known—the solid, the liquid, and the gaseous. Sir J. J. Thomson's mathematical investigations into the properties of a moving sphere carrying an electric

charge were the direct outcome of Crookes's researches. He found that such a sphere would have its inertia, or mass, increased by a definite amount, depending on the charge and the velocity, and so laid the foundations for an electrical explanation of mass, the first step towards our present electrical theory of matter.

The possibility that electrons might have a separate independent existence, and perhaps afford a basis for a general theory of physical phenomena, appears to have occurred to several physicists very nearly simultaneously; the more prominent among them being Lorentz, Larmor, Voigt, and Drude. Lorentz was the first to publish, in 1892, a definite electron theory, founded mainly on the optical properties of media moving relatively to each other, the phenomenon known as the *aberration of light*[1] forming the starting-point. Larmor's starting-point was an attempt to apply MacCullagh's ether to the representation of general electrical theory, and the concept of the electron was definitely introduced by him in 1894, in order to explain the relation of the observed interactions of permanent magnets to the corresponding interactions of circuits carrying electric currents, as this relation could not be accounted for on the vortex-atom theory of matter previously referred to.

These lines of development were, however, purely mathematical, and the mathematics involved were of an advanced type, appealing only to a comparatively small body of physicists, and something more striking was needed to make the electron hypothesis anything more, to physicists generally, than a tentative working hypothesis for mathematicians.

This was provided by Zeeman's discovery, in 1897, of the phenomenon now known as the Zeeman effect. He observed that the bright lines of the sodium spectrum were perceptibly widened when placed in

[1] See *Problem of the Universe*, p. 79.

a strong magnetic field. This he communicated to Lorentz, who succeeded in accounting for it on the basis of his electron theory, and further predicted that in a certain aspect relatively to the magnetic field the lines would be doubled, while in another aspect they would be trebled; also that the double and triple lines, respectively, would emit light polarized in certain definite ways. The predictions were confirmed in every detail by subsequent observations, and from the results of these observations Zeeman was able to calculate the ratio of the charge of an electron to its mass. These results brought the electron theory prominently into notice, but the extremely high value obtained for the ratio led to their being regarded with a good deal of doubt until the value obtained by Zeeman was confirmed shortly afterwards by Sir J. J. Thomson who, in a brilliant series of the most delicate measurements, made by quite a different method, showed that the ratio was about 1,700 times as great as in the case of the hydrogen ion in ordinary electrolysis. Further investigations, made by Sir J. J. Thomson in 1898 and 1899, showed the charge to be the same as that of the hydrogen ion in electrolysis, from which it followed that the mass of one of these particles was only about one seventeen hundredth part of the mass of a hydrogen atom, the smallest mass previously known to be capable of separate existence. Both Sir J. J. Thomson's determinations and Lorentz's conclusion from the Zeeman effect showed that the electric charges carried by these extremely minute particles were invariably negative. Their extremely minute size, and very high velocities in highly exhausted vacuum tubes, amounting sometimes to 60,000 miles per second and even more, accounted for the various differences between them and ordinary matter which had led Sir William Crookes to designate them as a fourth state of matter. They also accounted for their

power of penetrating ordinary matter, which was first observed by Hertz in 1892.

In the year 1895 Röntgen had made the observation that when a vacuum tube was exhausted to a very high degree the walls of the tube became vividly phosphorescent during the continuance of the electric discharge, and at the same time rays [1] were emitted into the space outside the tube. He found these rays to be capable of rendering luminous a screen painted with a phosphorescent substance, even when they had first to pass through a solid body, such as the hand, in which case the different absorption of different portions made all the bony framework visible to the naked eye. He also found that these shadow pictures could be reproduced on a photographic plate employed in place of the phosphorescent screen. It has usually been supposed that these rays consisted of thin luminous pulses excited by the electronic bombardment, but Bragg has pointed out that their observed properties may be explained quite as satisfactorily, and in some respects perhaps more so, by supposing them to be simply electrons which have lost some of their velocity in passing through the walls of the tube, and have at the same time acquired positive charges which exactly neutralize the negative ones.

Lorentz, in his mathematical investigations, treated the electron as a tiny spherical particle of matter carrying an electric charge; but though this conception has been of the greatest value in the mathematical development of the electron theory, it is obvious that it does not provide a basis for a theory of matter as a structure in the ether, such as Lord Kelvin attempted in his vortex-atom hypothesis; and Sir Joseph Larmor was the first to suggest a definite

[1] The terms *ray*, and *radiation*, the passage of rays, are used to denote any action which is transmitted only in straight lines passing through the source from which the action emanates.

physical concept of an electron as a strain-form in the ether. It was based on Lord Kelvin's model of the ether, which has already been referred to. The meaning of this concept will be most easily, as well as most completely, grasped, by following the line of thought by which Sir Joseph Larmor was led to its formulation while attempting to account for the discrepancy previously referred to in the observed relations between the interactions of systems of electric currents and those of permanent magnets, and those calculated from the Faraday-Maxwell theory of electrical action.

The first definite connexion between magnetic and other electric phenomena was established by the Swedish physicist Oersted in the year 1820. This discovery led Ampère to make a detailed investigation of the nature of the relation, and the result of his brilliant experimental research was to show that conductors carrying electric currents attract and repel each other just like magnets, and that the action between any two magnets at a considerable distance apart compared with their dimensions might be completely represented by the actions between two closed circuits carrying electric currents, the dimensions of the circuits also being small compared with their distance apart. Now it had long been known that every portion into which a permanent magnet may be divided is found to be itself a magnet, and this fact had led Weber to formulate his celebrated theory of magnetism, according to which every molecule of a magnetic substance is itself a magnet, and magnetization consists simply in turning the molecules of the substance round in such a manner that they reinforce, instead of neutralizing, each other's actions. Ampère suggested that the molecular magnetism of Weber's theory might be accounted for by the assumption that each of the molecules has an electric current circulating round it. The currents would then be brought into a more or less close approximation to parallelism when

a body was magnetized. The currents flowing in opposite directions round the adjacent portions of two neighbouring molecules would then destroy each other's effects, so that a magnetized rod might be considered as equivalent to a series of electric currents flowing in the same direction round its surface, and would therefore act like a helix carrying an electric current, as Ampère had experimentally shown to be the case. At the time that this theory was propounded it was open to the objection that every conductor, such as we are acquainted with, becomes heated by the passage of an electric current, whereas these molecular currents would have to be supposed devoid of heating effect, as otherwise a magnetic substance would afford a continuous supply of heat, which would be in conflict with experience. This difficulty is one of the many which are entirely removed by the electron theory, according to which these molecular currents are due to the unresisted motions of electrons within the atoms.

We can now state precisely the discrepancy between observation and theory which Sir Joseph Larmor was attempting to remove. It was found that the system of electric currents which was found experimentally to be equivalent to a given permanent magnet should, according to the Faraday-Maxwell theory, produce forces equivalent in amount, but in the opposite directions, to those actually observed. What was required therefore was to introduce such a change into the theory as would reverse all the forces acting between the atomic circuits of the magnet without altering their numerical values. The mathematics indicated the nature of the solution. The atomic circuits of the Faraday-Maxwell theory were absolutely invariable. They were completely isolated from the surrounding ether, so that no changes in the electric forces in the latter could have any effect upon them. If, however, it were possible to give the elasticity of the

ether some grip upon the atomic circuits, so that the changes in this elasticity accompanying changes in the electric forces in the surrounding field, would produce corresponding changes in the currents in the atomic circuits, then the mathematics showed that all the forces would be reversed in direction while remaining unchanged in magnitude.

This could be effected by supposing the vortex rings of Lord Kelvin's vortex-atom theory to be provided with cores composed of discrete electric nuclei, or electrons, consisting merely of centres of radial twist in the ether, and supposing the currents to be currents of convection, due to the circulation of these electrons around the circuit of the core. Such a vortex as this would be capable of moving about in the ether without experiencing any forces on the circulating electrons which would tend to break it up. The stability due to the spin would be sufficient for its permanent maintenance.

We thus arrive at the conception of an atom as something very like a miniature solar system, the place of the central sun being taken by a mass of electrons, and those of the planets by isolated electrons. There is strong experimental evidence for concluding that the planet-electrons are always negative. There is also reason to believe that they are disposed in rings or bands about the central mass, and therefore bear a closer resemblance to the system of small planets, known as asteroids in our solar system, than to the larger planets, which are comparatively isolated, except for their accompanying satellites.

The most complete theory of such an atom has been worked out mathematically by Sir J. J. Thomson on the hypothesis that the central mass consists entirely of the positive electrons corresponding to the negative planet-electrons, and the hypothesis accounts for a considerable number of chemical and other phenomena. The balance of evidence at present attainable appears

to me, however, to favour rather Sir Oliver Lodge's suggestion that the central mass may consist of an intimate admixture of positive and negative electrons[1]. Measurements of the relative masses, and what, in a sense to be further considered presently, may be called the relative sizes of atoms and electrons, and of the average distances between the centres of the atoms, show that (1) the ratio of the volume of an atom occupied by electrons to the volume which may be said to be unoccupied by them is of about the same order of magnitude as the ratio of the combined volumes of the Sun and planets to the volume of a sphere with the Sun as centre, and passing through Neptune, the planet most distant from the Sun; (2) the ratio of the volume of a solid or liquid body or dense gas occupied by atoms to the volume which may be said to be unoccupied by them, is of about the same order of magnitude as the ratio of the combined volumes occupied by the heavenly bodies to what is called empty space in the stellar universe. That is to say, if the views of the nature of matter now generally held by physicists be correct, then if a small body, such as a speck of dust, were magnified until it filled a space equal to that occupied by the visible stellar universe, the result would be something very closely resembling our universe. There would, therefore, be nothing inconceivable or absurd in the suggestion that our universe might itself be but a speck of dust, or a minute portion of some body, in a greater universe. It would, however, be fruitless to endeavour seriously to elaborate such a suggestion, for the simple reason that we could imagine no possible method of putting it to the test of observation.

In such a view of matter, the differences between the different kinds of material atoms known to chemists will consist solely in differences of number and arrangement in the electrons constituting the

[1] See *Problem of the Universe*, p. 407.

atom, so that the electrons may be considered as the ultimate particles of which all material bodies are built up. It is, however, impossible to form a representation of a positive electron apart from its corresponding negative one, or of a negative electron apart from its corresponding positive one, so that the *electric doublet*, consisting of a pair of electrons, positive and negative, may more properly be considered as the fundamental unit from combinations of which all material bodies are formed.

The formation of these electric doublets is illustrated by Sir Joseph Larmor in the following manner: Let a narrow tubular channel of molecular dimensions be supposed to be formed in the Kelvin model of an ether, having elastic resistance to twist, and then suppose the walls of this channel to be grasped and twisted round the axis of the tube: this twist will be distributed through the medium and, as a result, there will be lines of twist displacement, all starting from one extremity of the tube and terminating at the other extremity. So long as the walls of the tube are held in this position by external constraint, one extremity will constitute a positive electron in the medium, while the other will be the complementary negative one. If the walls of the tube are released, both will disappear together. Now suppose that, before this release takes place, the tube is filled up with ether constituted as we have imagined, with the exception of small vacuous nuclei at the extremities, which nuclei will then assume the spherical form. If the external constraint be then removed, the effort of release in the surrounding medium will twist the spheres within the tube to a slight extent until a condition of equilibrium is attained in which the elastic resistance to twist of the medium inside balances that of the medium outside. Each doublet will then consist of a self-locked intrinsic strain in the medium, analogous to that existing in a wire

which has been welded into a ring after a twist has been put upon it. A positive electron will then differ from a negative one essentially as the reflection of an object in a plain mirror differs from the object itself; but it is not necessary that the tube should be cylindrical in section and therefore the vacuous extremities equal in size: the experimental evidence tends, in fact, to suggest that the positive electrons are considerably larger than the negative ones. The electrons forming the terminals of such a doublet might be drawn apart to any distance, but the twist thus set up in the medium would tend to bring them back to their original positions in close juxtaposition, so that in this case the electric attraction between the positive and negative electrons would be accounted for as arising from ether twist. Mathematical investigation shows that all electric actions can be accounted for in a similar manner, so that electric forces may be regarded as being simply ether twists.

Such an electric doublet would, as Sir Joseph Larmor points out, move through the ether without resistance in the direction of its length, provided the nucleus were so small that the ether displacement arising from it would be negligible, but that any sideways motion would be resisted by giving rise to ether twist, that is to say to electric forces, and provided also the inertia or mass of the ether be sufficiently great. The assumption that the ether displacement is negligible is a convenient and legitimate one for much of the mathematical development, but it must be considered as only approximately true, as if the ether displacement were absolutely negligible for all purposes, the electrons would be subject to the electric forces only; that is to say, to ether twist only; and it has been shown that if that were the case an atom would have no definite size, but would vary in size with the forces acting on it. This would not be in accordance

with observation, which shows that similar atoms are of the same size under all circumstances. Moreover, this ether displacement appears to me to afford the only satisfactory explanation of gravitation.[1] Now if the ether displacement of the nucleus is not absolutely negligible, it does not seem possible to account for its mobility through the ether if the nucleus be a vacuole. If, however, the nucleus were filled with ether, similar to the external ether, or with ether differing, say in its elasticity, for example, from the external ether, but not changing abruptly at a definite surface, it would then become capable of free mobility.[2] Although every electron must have its complementary partner, there is nothing to prevent a change of partners taking place under suitable circumstances.

It has already been pointed out that the observed rapidity of transmission of the electric waves constituting light necessitates a very high elastic resistance to twist in the ether, and this involves a correspondingly high density. In 1907 Sir Oliver Lodge arrived at the conclusion, by a totally different line of argument, that this density could not be less than a billion times the density of water, and might be very much greater. The ether must therefore be the most massive substance in the universe, and what we call a solid material body must consist, as Sir J. J. Thomson has pointed out, chiefly of holes. The passage of a solid body through the ether, that is to say, through what is popularly called empty space, closely resembles the passage through mercury or melted lead of a fragment of very open gauze made of the finest possible wire. Not only must the ether be enormously more dense and massive than the densest bodies known to us, such as gold or lead for example, but it must be practically immovable

[1] See *Problem of the Universe*, p. 433.
[2] Ibid., p. 554.

except in the immediate neighbourhood of a moving electron. Lorentz conceives the ether as being absolutely immovable, but such an ether could not be made the basis of any mechanical method of accounting for electric actions. Differences in twist in different portions of the ether necessarily involve ether flow, and when ether twist is regarded as the equivalent of electric force, ether flow will correspond to magnetic force. This flow will, however, be unresisted, owing to the perfect fluidity of the ether, and will give rise to no observable phenomena, so that ether flow, if arising from any other cause than ether twist, that is to say, electric force, will no longer correspond to magnetic action. In fact, the expression of magnetic action in terms of magnetic force, or ether flow, though often a convenient one, is not fundamental. All magnetic actions can be represented directly in terms of electric force, that is to say, of ether twist.

Although the ether must be in motion in the immediate neighbourhood of a moving electron, there can be no sensible dragging along of the ether by a material body as a whole when this body is moving through the ether, as in the case of the earth or of any of the heavenly bodies. Close to one of the electrons of an atom the speed of ether flow would attain a value comparable with the speed of the electron in its orbit, but Sir Oliver Lodge calculates that at a distance of only a millimetre from the electron the speed of flow would be less than a millionth of a millimetre per century. Before the open net-like structure of what we call solid bodies was recognized, the difficulty of conceiving the free permeability of matter by ether[1] led to many attempts to formulate an ether theory in which the ether should be dragged along with the heavenly bodies as they move through it. The most

[1] We should now change this expression into the permeability of ether by matter.

brilliant of these was made by Sir George Stokes about half a century ago, but its result was only to show the utter impossibility of such a conception. For if the ether were dragged along, by the earth, say, there would have to be a similar drag in the case of all other heavenly bodies, and this would be irreconcilable with the twistlessness of all ether motions in the absence of electric forces, which is a necessary consequence of observed phenomena.

Clerk-Maxwell suggested that it might be possible to detect the difference, which should exist if the ether were stagnant and not dragged along by the earth, in the time of propagation of a ray of light between two points at a fixed distance from each other, when the straight line joining them was placed, first in the direction of the earth's orbital motion, and then in a direction at right angles to it. The experiment was made by Michelson in 1881, and no effect whatever was observed, and an absolutely negative effect was obtained when the experiment was repeated by Michelson and Morley in 1887, with much greater refinements of detail. The path traversed by the ray was eleven metres in length, and the expected retardation was rather less than the thousand-billionth of a second, and such was the delicacy of the method employed that it was estimated that a retardation of a twentieth part of this minute interval of time could be detected.[1] A variation of the experiment with still greater refinements was carried out by Michelson in 1897, the arrangement being adapted to determine whether any difference could be detected in two horizontal paths each about 200 feet long, and one of which was 50 feet vertically above the other. If the ether were at all dragged along by the earth, the drag would be greater at the lower level than the higher

[1] For a description and explanation of the method of measurement employed in this wonderful experiment, see *Problem of the Universe*, p. 86.

one; and the observer concluded from the absolutely negative result that if any such carrying along of the ether did occur, it must extend to a distance of something like the earth's diameter of 8,000 miles—a practical impossibility. The negative result of the 1887 experiment would have been accepted without hesitation as demonstrating that the ether is carried along with the earth, had it not been for the apparently insuperable difficulties which such a conclusion would have involved. Some physicists actually did so accept it, but the results of the 1897 experiment added still further to the difficulties involved in such acceptance. A bold and startling solution of the problem was suggested by Fitzgerald and Lorentz almost simultaneously, viz. that the whole apparatus, and therefore, of course, all other solid bodies, undergoes a certain contraction in the direction of motion when moving through the ether. In the case of bodies carried through the ether by the earth's motion in its orbit this contraction would amount to about one part in two hundred millions, and Lorentz showed that a contraction of this small amount could be deduced from what appeared to be reasonable assumptions with respect to the intermolecular forces. Sir Joseph Larmor afterwards found, in the course of his mathematical development of the electron theory, that a contraction of just the amount required must necessarily occur if the intermolecular forces of material bodies are entirely due to electrical actions between systems of electrons constituting the molecules. It would involve a shortening of the diameter of the earth lying in the direction of its orbital motion by about six and a half centimetres.

The discovery of the phenomena of radioactivity afforded further striking confirmation of the electron theory of matter by the satisfactory manner in which this theory accounted for the new phenomena. The fact that Röntgen rays were found to be capable of

exciting phosphorescence to a very marked degree in a large number of substances led to investigations with the object of determining whether phosphorescence was generally accompanied by Röntgen radiation. Henry had observed, early in 1896, that sulphide of zinc which had been rendered phosphorescent by exposure to the light of the sun or of burning magnesium, thereby acquired the power of acting upon a photographic plate through a screen of black paper or thin aluminium foil; and very shortly afterwards Becquerel observed a similar action in the case of the double sulphate of uranium and potassium. Further investigation showed that this property was inherent in the uranium, and was exhibited by its non-phosphorescent salts, and that the radiation from uranium was capable of *ionising* gases exposed to it; that is to say, breaking up molecules of the gases into their constituent *ions*. This discovery led many other physicists to take up the subject, and Professor Rutherford, in a brilliant and extensive series of experimental researches, found that the radiation from uranium and its compounds is of three distinct kinds, which he called alpha rays, beta rays, and gamma rays respectively. The beta rays he found to be simply streams of negative electrons emitted with much higher velocities than any hitherto observed, being comparable with, though always less than, the velocity of light, and with correspondingly high penetrative power. The alpha rays were found to consist of streams of much more massive particles, subsequently shown by Sir William Ramsay and Mr. Soddy to be helium atoms carrying positive charges. The gamma rays, which were found to have even more penetrative power than the beta rays, were found to carry no electric charges, but bore a close resemblance to the most penetrating Röntgen rays, and, with them, are generally supposed to consist of ether pulses such as might be expected to arise from the sudden emission

or stoppage of electrons. Bragg, however, as we have seen, believes them to be uncharged particles moving with very high velocities. Thorium was found independently by Schmidt and Madame Curie to have radio-active properties similar in character to those of uranium; and a systematic examination of the constituents of pitchblende, from which both uranium and thorium are obtained, led to the discovery, by Monsieur and Madame Curie and Monsieur Bemont, of an even more radio-active metal than either uranium or thorium, to which they gave the name of radium. It was discovered in 1893 by P. Curie and A. Laborde that radium compounds have the remarkable property of maintaining themselves at a temperature several degrees above that of the surrounding atmosphere. Radium, therefore, forms a continuous source of energy, and the experimental facts leave little or no room for doubt that this energy is derived, not from any external sources, but from the disintegration of the substance itself.

Further investigations by numerous workers showed radium itself to be a product of the disintegration of uranium, and led to the discovery of a whole series of substances, beginning with uranium and ending with polonium, another radio-active substance which had been discovered in pitchblende, so related that each member of the series is a product of the disintegration of the one which immediately precedes it, as shown on the next page:—

Their rates of disintegration vary within very wide limits; for example, a period of about a thousand million years would be required for the decay of uranium to the extent of half its original amount. In the case of radium the period is about 1,258 years, while in the case of Radium A it is only three minutes. Alpha rays, that is to say helium atoms, are emitted during most of the stages of disintegration from Uranium to Polonium, but not in all. There are

Uranium
↓
Uranium X
↓
Ionium
↓
Radium
↓
Radium emanation
↓
Radium A
↓
Radium B
↓
Radium C
↓
Radium D
↓
Radium E_1
↓
Radium E_2
↓
Polonium
↓
(Lead ?)

experimental reasons which appear to indicate that lead is the chief disintegration product of Polonium.

The series of disintegration products of thorium, and also that of actinium, which is found in association with thorium, and nearly resembles it, are of similar general character. Although no one of these series appears to be related in lineal descent to either of the others, the close resemblance in their general character suggests the possibility at least of their common derivation, perhaps from a form of radio-active substance not capable of existing under present terrestrial conditions.

Investigations by numerous observers have now

shown that radio-active substances are very widely distributed throughout the earth, and that practically all known terrestrial substances, when tested by sufficiently delicate methods, exhibit some traces of radio-activity. Much of this is doubtless due to the presence of traces of the substances known, from their high radio-activity, as radio-active substances; but results obtained by many observers, and more particularly those due to N. R. Campbell, appear to show, beyond all reasonable doubt, that this universal diffusion of the property of radio-activity is largely due to its being an inherent property of every known kind of matter. Amongst the mass of evidence leading to this conclusion[1], I must note one most significant result obtained by Campbell, viz. that in the case of every metal examined by him, with the one exception of aluminium, the radiation which appeared to emanate from the atoms of the metal itself, and not from traces of radio-active impurities, possessed a higher penetrative power than the most penetrating rays emitted by radium.

Deferring for a moment the consideration of the special significance of this result, let us now examine the bearing of the phenomena of radio-activity on the electron theory of matter, which represents it as built up of atoms consisting of miniature solar systems formed of electrons distributed in bands or rings revolving about a central agglomerated mass of electrons.

The radio-active elements known to us are all bodies of relatively high atomic mass; that is to say, they are exceptionally closely packed bundles of matter. As far as it has been possible to obtain the various products of disintegration in sufficient quantity to allow of the atomic mass being determined, it is found that the atomic masses of successively formed products constitute a steadily diminishing series, each

[1] See *Problem of the Universe*, p. 338.

consisting of a less closely packed parcel of matter than its immediate predecessor. Each step in the disintegration is accompanied by the liberation of a large quantity of energy.

Now the electron theory of matter obviously allows of the breaking up of atoms, and the rearrangement of the electrons to form fresh atoms. Sir J. J. Thomson's mathematical investigation into the stability of systems of rings of negative electrons revolving about a central mass of positive electrons, though obviously only a crude first model, leads to the result that the loss of energy by radiation from the system would tend to an ultimate disintegration in which electrons would be emitted and the atoms would break up into others containing a smaller number of electrons, and therefore of lower atomic mass. It therefore accounts satisfactorily for the continuous decrease in the atomic masses of the successive products of disintegration. It also accounts for the emission of beta rays, or streams of electrons, which is observed in some of the stages. The frequency of the emission of alpha rays, that is to say streams of helium atoms, at so many of the stages of each of the three series, sometimes with and sometimes without an accompanying emission of beta rays, or streams of electrons, appears to suggest that the radio-active atoms are of more complex structure than would be represented by a simple series of rings or bands of isolated electrons revolving about the central mass. This continual recurrence of the emission of helium atoms appears to point to the conclusion that the atoms of the radio-active system are not simple miniature solar systems, but systems of systems; that, in fact, some at least of the rings or bands of revolving particles consist, not of simple electrons, but of helium atoms, themselves built up of rings of electrons revolving about their own central miniature suns.

The continued absorption of energy in breaking

up the complex radio-active atoms of the earlier members of the series into atoms of ever-decreasing complexity would be favoured by the continuous fall of temperature which has been taking place in all parts of the earth for millions of years. The question now naturally arises whether it would be possible for conditions to prevail under which the building up of radio-active substances would take place instead of their disintegration into simpler forms. We learn from the mechanical theory of heat that such a building up, such a closer packing up of parcels of matter, would be facilitated by an increasing temperature and also by an increasing external pressure. Now it is known that at a certain early stage of the transition from a nebula to a star system, the pressure and temperature must be increasing together, and Arrhenius suggests that this is the stage in the history of a star system at which the building up takes place. This is a stage through which the solar system must have passed long since; the sun and all the planets are now in the cooling stage in which the temperature of every portion is steadily decreasing.

The discovery of the phenomena of radio-activity, by showing that previous estimates of the age of the earth must be very largely increased, has removed what many geologists and biologists had regarded as the almost insuperable difficulty of accounting for the formation of the various rock strata, and for the development of the various forms of life of which fossil remains are preserved, within the time limits apparently determined by the observed rate of increase in temperature with the depth below the earth's surface. Lord Kelvin showed, many years ago, that, on the assumption that the cooling of the earth had occurred in accordance with the laws of the flow of heat alone, the formation of its solid crust must have begun less than two hundred million years ago at the

outside. Life, he considered, could not have made its appearance on the earth much more than a hundred million years ago.[1] We know now, however, that this cooling is not taking place subject only to the laws of the flow of heat, but that it is retarded by the continuous liberation of the heat energy of disintegration of radio-active material throughout the substance of the earth. The existence of radium in the earth, to the extent of 4·6 parts in one hundred billions, would be sufficient to compensate for the earth's present rate of loss of heat by conduction, and the observations of several physicists suggest that the amount actually present approaches this so nearly as to allow of a practically indefinite extension of the period covered by geological history; that is to say, the period which has elapsed since a solid crust first began to form on the surface of the liquid earth.

Another somewhat similar difficulty has been resolved in the same way. Previously to the discovery of radio-activity, the maintenance of the enormous emission of heat energy by the sun could be accounted for only by the contraction which accompanies its gradual cooling, and Lord Kelvin showed that if this were the only available source the sun could not have given light to the earth for more than 500,000,000 years at the outside, and probably not for more than 100,000,000 years. Even the longer period was quite insufficient in the opinion of many geologists. Here again, the discovery of radio-activity removes the difficulty, for, although we have no direct evidence of the presence of radio-active substances in the sun, the indirect evidence is overwhelming. In the first place, there is the general similarity in the substance of the sun and earth. Then again, there is the existence of helium, the presence of which in the sun was revealed by the characteristic green line in its spectrum some time before it had been discovered on the earth. And we

[1] *Popular Lectures and Addresses*, vol. ii, p. 69.

have seen that helium is an almost constant product of radio-active disintegration. The conclusion that radio-active substances are present in considerable quantity in the sun receives further confirmation from the fact that various observed phenomena are satisfactorily accounted for by the hypothesis of the emission of large quantities of beta particles, that is to say negative electrons, from the sun. The disintegration of radio-active matter in the sun would give rise to such emission, and in the absence of such disintegration the emission would be unaccounted for. Among these phenomena are: the distribution of the *streamers* forming the outer corona of the sun, and extending to distances of as much as 400,000 miles from its surface; the observed negative electrification of the earth's atmosphere; the relation between the frequency of sun-spots and a certain class of terrestrial magnetic disturbances, or magnetic storms as they are called; the luminosity of the masses of solid particles forming the tails of comets, considering the low temperatures which must prevail except when they are in the immediate neighbourhood of the sun. The luminosity may very simply be accounted for by the impact of electrons leaving the sun in large quantities, and probably also entering the sun from other stars.

Now if negative electrons arising from the disintegration of radio-active substances are emitted in large quantities from the sun we should expect an emission also of positively charged particles similar, or at any rate corresponding in character to, the alpha particles of terrestrial experience, provided the lower speeds do not prevent their escape from the sphere in which the sun's attraction is the paramount gravitational force, and the observed presence of helium in large quantities in the sun points to the conclusion that these positively charged particles would be identical with, and not merely similar to, our own

alpha particles. Now I have shown[1] that when account is taken of the repulsive force of the sun's powerful luminous radiation, which is much greater than the sun's gravitational attraction upon particles so minute as the beta and even the alpha particles, both kinds of particles may be expected to leave the sun in large numbers, but more beta than alpha particles. The conclusion is in accordance with the known negative electrification of the earth, and is shown to lead to a modification of Arrhenius's theory of the aurora, which accounts for the observed phenomena even more completely than the original form of his theory.

Finally, the sudden explosive disintegration of radio-active substances is the one conceivable source of the energy required to project masses of metallic and other vapours from the sun's surface, as observed in solar disturbances, to distances sometimes as great as 370,000 miles, with initial velocities of some 300 miles a second, or about 600 times the maximum initial velocity of a rifle bullet. In the first place, the only conceivable source of this energy is the disintegration with explosive violence of some substance within the sun's interior. If the energy so liberated could be applied to setting the gas in motion under as favourable conditions as when it is applied to the bullet in a rifle, a very unlikely supposition, the solar explosive would have to be more than 300,000 times as powerful as the powder used in the rifle. Moreover, only a portion of the solar explosive energy can be utilized in accelerating the mass of gas, probably a small proportion only of this energy, as the remainder must be expended during the passage from the sun's interior to the surface. It is probable, therefore, that the energy developed in these solar explosions is at least 1,000,000 times as great as could be produced by the strongest terrestrial explosives. Now we have

[1] *Problem of the Universe*, p. 372.

to bear in mind that the materials of the sun are practically identical with those of which the earth is composed. The explosive must therefore be built up of elements with which we are familiar, and it is beyond the power of the chemist's imagination to picture any chemical explosive of a power approaching this; that is to say, any explosive undergoing mere molecular disintegration unaccompanied by the atomic disintegration which is the source of what are called radio-active phenomena. Moreover, all known chemical explosives disintegrate through a rise of temperature, while the solar explosive must undergo disintegration during the tremendous fall in temperature accompanying its transit from the interior of the sun to its surface; and this transit will be accompanied by an enormous fall in pressure, so that both the favouring conditions of radio-active disintegration are present to a degree altogether unapproachable under terrestrial conditions. Further, we know that a sufficiently rapid disintegration of such a substance as radium would produce the observed results; for the energy liberated in the emission of a group of alpha particles from a mass of radium is about 600,000,000 times as great as that of a rifle bullet of the same mass as the aggregate mass of the group, and travelling with a velocity of 1,000 metres a second. The observed presence of helium in exceptionally large quantities in the immediate neighbourhood of the sun-spots (the centres of disturbance) provide one more confirmation of the validity of the conclusion that radio-active material is present in considerable quantity in the sun.

The presence of 3·6 grammes of radium per cubic metre of the sun's mass, or two and a half parts by weight in a million, would be sufficient in itself to account for the whole present rate of emission of solar energy, and a much smaller amount would suffice to account for a very great prolongation beyond what

would otherwise be possible of the sun's life as a heat-giving body.

Further confirmation of the view that the great solar cataclysms are caused by the explosive disintegration of radio-active substances is afforded by phenomena observed in connexion with the birth of the new star known as Nova Persei, which first became visible to terrestrial observers in 1901, some 120 years after the actual occurrence of the phenomena then observed, for the distance is about 120 light-years, or about 720 billion miles. It made its appearance as a star of the third magnitude on the 22nd of February, 1901, and in the course of the following twenty-four hours had become the brightest star in the heavens with the exception of Sirius. Every available instrument was of course directed upon it, and in the course of a few days it was found to be diminishing in brightness and undergoing various periodical fluctuations in brightness and in colour. The spectroscope showed that masses of comparatively cool hydrogen mingled with metallic vapours were being ejected from the star at a speed of some 450 miles a second, indicating an explosive violence considerably greater than has ever been observed in connexion with the solar prominences. Moreover, about a month after the first appearance of the new star, two luminous rings were telescopically observed to be moving outwards from the star as centre, one travelling with about double the speed of the other, and it was found possible to follow their outward progress for nearly a year, owing to the formation of luminous clouds wherever they traversed nebular matter. Some extensive nebulae whose existence had never been suspected were discovered in this way. This appeared to me to suggest that the particles composing the expanding luminous rings were electrically charged, like the alpha and beta particles, and that the luminosity was due to their ionising action on the

gaseous masses of nebular matter. This supposition was confirmed on ascertaining from the observed angular motion and the approximately known distance of the star, the actual speeds at which they were travelling; for these speeds were found to be about 11,600 miles and over 23,000 miles respectively per second—speeds of the order to be expected if the particles were produced by the disintegration, as a result of the collision between two extinct stars, which was indicated by the observations of large masses of radio-active material. Of the two alternative hypotheses which I suggested[1] to account for them, the most probable one appeared to me to be that the more slowly moving ring was composed of ordinary alpha particles, that is to say of helium atoms carrying positive charges, while the more rapidly moving particles were hydrogen atoms carrying the corresponding negative charges. The alternative hypothesis, which would be more in accordance with terrestrial experience, was that the faster-moving group consisted of hydrogen atoms carrying, like the helium atoms, positive charges. It would, however, in that case be necessary to assume that the comparatively small ionisation which would be caused by the escape of the corresponding negative electrons moving at a much higher speed had escaped detection. This hypothesis appeared to me to be the less probable of the two, because it is difficult to imagine that this latter ionisation would entirely escape detection.

Many such new stars have been observed by astronomers, but Nova Persei is the first which has been observed since the development of scientific knowledge and of instruments of observation has made it possible to ascertain the nature of the phenomenon—a collision between two extinct or non-luminous stars, giving rise to the appearance of a very bright star which afterwards became gradually

[1] *Problem of the Universe*, p. 386.

obscured by the clouds of emitted gases and developed into a nebula surrounding a central body—a nebula which will ultimately in all probability give rise to a star system in some such manner as I have outlined in chap. xx of *The Problem of the Universe*.

This brief description of the phenomena accompanying the birth of a new star, and its reproduction on a grander scale of the phenomena of radio-active disintegration as investigated in our laboratories, can hardly fail further to impress upon our minds the analogy already drawn between the smallest visible particle of matter and the vast sidereal universe in the midst of which our whole solar system is but a mote. It may therefore serve to prepare our minds for the attempt to complete, as regards its more prominent features, the scheme of the material universe as it presents itself to the physicist of to-day by showing how even the mysterious action of universal gravitation may find its place in it; for this will necessitate our definitely facing the possibility of the whole sidereal universe as known to us forming but a limited, and perhaps a comparatively insignificant, portion of a greater unknown universe within which it is comprehended.

Before leaving the subject of radio-activity I must, however, point out how the identity of the beta particles emitted from such substances as radium, in everything except the maximum velocities attained, with the electrons liberated by electrical action, has made it possible to obtain direct experimental evidence of the adequacy of the representation according to which the ether strains which manifest themselves to us as electrical actions form the essential basis of matter.

Sir J. J. Thomson has calculated the ratio of the masses of the rapidly moving particles emitted by radium to the masses of the same particles when at rest or moving slowly, on the assumption that the

distribution of electric force is the same as would be due to a charged point, so long as we confine our attention to the field outside a very small sphere having its centre at that point, and on the further assumption that the whole of the mass is electrical. Experimental measurements made by Kaufmann, in 1892, of the velocities, under the influence of electric and magnetic forces, of the beta particles emitted by radium agree very closely indeed with the theoretical results throughout the whole range of velocities observed, which extended up to about 95 per cent of the velocity of light; that is to say, the observed velocities ranged up to more than 170,000 miles per second. This close agreement shows that the motion of an electron through the ether may be represented, to a close approximation, by that of a small material sphere carrying an electric charge, and leads to the conclusion that, within the high limits of accuracy attained in these experiments, the inertia of the electron arising from the ether carried along by its nucleus when in motion is negligible in comparison with that which arises from the drag of the ether due to the electric charge; that is to say, to the strain distribution surrounding the nucleus. The advantage of being able to employ a charged sphere as the representation of an electron lies in the fact that such a representation is very amenable to mathematical treatment, and the meaning of the justification of such a representation by Kaufmann's experiments is simply that the actions which would be called into play by the motion of such a charged sphere are subject to approximately the same relations as those arising from the motion of an existing electron. We must, however, never forget the crudity of the representation, which cannot in any sense be regarded as a possible picture of what is actually taking place in the ether.

Newton's general statement of the law of gravita-

tion, that every particle of matter in the universe attracts every other particle with a force proportional to the product of the masses of the two particles divided by the square of the distance between them, was expressly put forward as an hypothesis to be tested by observation. Its application to the motions of the heavenly bodies involved its correctness only for the attractions of bodies separated by very great distances in comparison with their sizes. In this respect there is certainly no physical law whose accuracy has been more firmly established. There are, however, some minor problems in the motions of the heavenly bodies which have not yet been completely solved, and which may possibly find their solution in Newton's law of gravitation not being an absolutely exact law but only an exceedingly close approximation.[1] The only direct evidence of the validity of the law at moderate distances is the fair agreement with each other of measurements of gravitational acceleration under varying conditions, and they are not sufficient to establish the law of the inverse square with any considerable accuracy. The most convincing indirect evidence in its favour is the observed fact that the weight of a body does not sensibly vary with its direction, or with its position except as regards change of distance from other bodies. This shows that the transmission of the gravitational attraction between two bodies is not affected by intervening matter, and on the assumption that the action is transmitted by the intervening ether, would lead to the conclusion, already arrived at by other and independent considerations, that material molecules are widely separated from one another in comparison with their dimensions. If we start by accepting the modern view of matter as here presented, then the accuracy of the law at all sensible distances may be directly inferred from its astronomical

[1] See *Problem of the Universe*, pp. 418 and 596.

exactness, in consequence of the known smallness of the electrons compared with the distances separating them. The open structure of the atom which is a consequence of this enables us to apply an investigation made by Lord Kelvin in 1862 to show that the cohesion of solids and liquids can be accounted for by gravitational attraction.[1]

Some investigations of Laplace, in connexion with the theory of the motion of the moon relatively to the earth, show that gravitational attraction cannot be subject to sensible aberration, and therefore that, if it be transmitted by means of the ether in the form of radiation, the speed of transmission must enormously exceed that of light. This condition excludes many of the recent hypotheses which have been proposed to account for gravitation. Other recent hypotheses are disposed of by the consideration that they introduce complexities which would destroy the consistency as well as the simplicity of the electron theory, which has already led us so far towards the unification of all the known phenomena of inanimate nature.

The difficulty of obtaining a solution of the problem is emphasized by the fact that both Lord Kelvin and Sir George Darwin attempted to modify in such manner as to bring it into agreement with observation the very artificial hypothesis of extramundane corpuscles, which was propounded by Le Sage in the year 1750. Neither attempt was successful. According to this hypothesis gravitation was assumed to be due to the impact upon gravitating bodies of extremely minute corpuscles flying through space in every direction with enormous velocities (for if their velocities were moderate they would act as a resisting medium and impede the planetary motions to an observable extent), and passing across the known universe from

[1] See *Problem of the Universe*, p. 428.

and into a greater universe of which the known universe forms but a portion.

An examination of the various hypotheses which have been propounded[1] has convinced me that only two of them fulfil the prescribed conditions, and it has been shown that both of these provide also for the non-electric forces on the electrons which are required to account for the observed uniformity in the sizes of the atoms, and involve a variability of gravitational mass with motion through the ether of the character which has been shown to be necessary, and sufficient, to account for the more important of the observed astronomical anomalies to which reference has already been made.[2] Both of these hypotheses represent gravitational action as arising from ether pressure on the nuclei of the electrons, due to ether flow, the distinction between them consisting in the nature of this flow. Both of them also involve the necessity of regarding our universe of matter and ether as forming a limited portion only of a greater universe, but the two hypotheses lead to totally different conceptions of the nature of the spatial relation of our universe to the greater one within which it is assumed to be included. Before stating these alternative hypotheses it will be well to remove two preliminary difficulties which might otherwise be raised as objections to either of them. The first of these consists in the nature of two properties which Clerk-Maxwell showed, in 1865, must be possessed by the ether in order that it may be capable of forming the medium of transmission of gravitational action. In the first place, the intrinsic energy of spin of the ether must everywhere have an enormously high value determined by the greatest possible value of gravitational force in any part of the universe. (In the Kelvin model of the ether this would be

[1] See *Problem of the Universe*, chap. xxiii.
[2] *Problem of the Universe*, Appendix P.

represented by exceedingly massive disks spinning at an enormous speed.) In the second place, the presence of material bodies must so influence the ether as to diminish this energy wherever there is resultant gravitational attraction. Maxwell was unable to understand in what way a medium could possess such properties, and was therefore led to abandon the idea of seeking for an explanation of gravitation in action transmitted by the ether. The electron theory entirely removes the difficulty by showing, quite independently of gravitational action, that the ether possesses both the requisite properties. It is a necessary consequence of the nature of the electron as consisting of a strain-form in the ether that the presence of matter composed of electrons should diminish the elasticity, and consequently the intrinsic energy, of the ether in its neighbourhood. Further, Sir Oliver Lodge's determination of the minimum density of the ether shows the intrinsic energy to be so great that the amount permanently existing in every cubic millimetre of space, and which is at present completely inaccessible to us, must, on the lowest estimate, be equivalent to the output of a million kilowatt electric power station for thirty million years. This would allow of the existence in the universe of gravitational attraction ten thousand million times as great as its known value at the sun's surface, the value at the sun's surface being about twenty-seven times as great as its value at the earth's surface.

The second difficulty is that while Kaufmann's experiments appear to show that the mass (in the sense of inertia) of the electron is entirely electric in origin, that is to say entirely due to ether twist, the two hypotheses in question completely fulfil all the requirements which I have indicated only when gravitational mass is assumed to be of hydrodynamic [1]

[1] Mass assumed to arise from the resistance of the ether due to the displacement of the latter by the nuclei of the electrons

origin; that is to say, to be due to the ether displacement of the nucleus of the electron, not to ether twist; and if this be the case the hydrodynamic mass must necessarily contribute to the inertia, which will, therefore, not be entirely of electric origin. This objection was actually raised to my conclusion that these two hypotheses would meet all the requirements[1], and the answer to it is that the extremely small value of the gravitational, as compared with the electric, force between two electrons shows that a hydrodynamic mass, far too small to be detected in Kaufmann's experiments, would be sufficient to account for gravitation, on the basis of Sir Oliver Lodge's conclusion that the electro-magnetic, like the hydrodynamic, mass of an electron is proportional to the density of the ether. Sir Oliver Lodge has shown that the electric force between two spherical electrons in contact is about 10^{42} times as great as the gravitational force; that is to say, the ratio is about that of a million billion trillions to unity. He has expressed this result in the easily understandable form: "If the opposite electricities were extracted from a milligramme of water and given to two spheres one mile apart, those two spheres would attract each other with a force equal to the weight of twelve tons." The reason that the gravitational force between two electrified bodies at great distance apart so largely exceeds their electrical attraction or repulsion, is that the gravitational action between aggregates of electrons is cumulative for all the electrons, while the electric actions of opposite electrons in each aggregate neutralize each others effects at a distance.

is known as *hydrodynamic mass*, because of its analogy with the apparent increase in the mass of a moving solid body when immersed in water or other fluid. If the fluid were, like the ether, without viscosity, that is to say, if it offered no frictional resistance to the motion of the solid, the whole of its resistance would be represented by an apparent increase in the mass of the moving solid body.

[1] *Problem of the Universe*, p. 613.

The electric mass, or inertia, of a body consisting of an aggregate of electrons is a constant quantity when the body is at rest, and is approximately constant when the body is moving through the ether at a speed which is small compared with that of light. If it could attain a speed equal to that of light the mass would become infinitely great, which probably means that it would disintegrate before attaining such a speed. The increase of mass is comparatively small until the velocity of light is very nearly approached. Thus a body of electric mass unity when at rest, will have a mass 1·22 at half the velocity of light, a mass of 1·81 at 90 per cent of the velocity of light, and a mass of 10·1 when its velocity is only less than that of light by one part in a million. The electric mass of a moving body is, moreover, a directed, or vector quantity; that is to say, its value depends on the direction in which the mass, or inertia, is measured, relatively to the direction in which the body is moving. The hydrodynamic mass of a body is not a directed quantity, nor does it vary in amount so long as the nucleus of the electron undergoes no change in size or shape.

We may now state the first of our two selected gravitational hypotheses, the pulsatory hypothesis. It is assumed that all the electrons in the universe are, in addition to their other movements, executing pulsations, that is to say alternate expansions and contractions of constant period; that none of the phases differ by more than a quarter of a period [1] for any one system of mutually attracting bodies, or that if such differences once existed they have been eliminated; and finally, that the period of pulsation is

[1] The period of a pulsation is the time occupied by an expansion and contraction. Two pulsations are in the same phase when they are expanding together and contracting together. When one is expanding while the other is contracting they are in opposite phases, or in phases differing by half a period.

such that the length of the ether wave accompanying it is so great that the half wave-length exceeds the greatest distance at which gravitational attraction is known by astronomical observation to act. The system of bodies will then, in consequence of the accompanying pulsatory ether flow, attract each other approximately according to Newton's law, but with just such small outstanding forces depending on the positions and velocities of the electrons as appear to be requisite in order to account for the observed astronomical anomalies.

A material system containing a mixture of atoms composed of electrons pulsating with every possible difference of phase would exhibit some very peculiar properties. For example, although two out of three atoms might attract the third, they would not necessarily attract each other. According to this gravitational hypothesis, it would therefore be quite possible for the bodies of any one star system to attract bodies belonging to one set of systems, repel those belonging to another, and exert no influence on those belonging to a third, and yet at the same time the bodies of each of the systems would obey the ordinary law of gravitation within the limits of their own system. If we call positive gravitational masses those which attract and are attracted by the bodies of our solar system, those which repel and are repelled by the same bodies might be called negative gravitational masses. Should such negative masses exist in the universe, we could not expect to obtain direct experimental evidence of the fact, for their repulsion by our positive gravitational system would separate them from us by too great distances for any interaction to be perceptible.

Professor Schuster has pointed out that the existence of negative gravitational mass would afford an explanation of the origin of the rotational velocity of the solar and other stellar systems. Unless we assume

that these rotational velocities were directly impressed by creative power, their origin, in accordance with dynamical principles, must have been accompanied by the generation of equal and opposite energy of rotation in other systems, and in this case the question arises as to how the corresponding systems have parted company if the gravitational forces in the universe are entirely attractive. It would, however, be quite possible for masses relatively neutral to the bodies of our system to find their way to our vicinity. That is to say, the hypothesis suggests the possible existence of weightless matter within the limits of the solar system.

We might imagine (ideally) such a pulsation as is required by this hypothesis being applied entirely over the external boundary of a limited ethereal universe, and communicated through the ether to the nuclei of the electrons; or we might, as Dr. Burton has shown to be possible, suppose the pulsations to arise from compressional ether waves continuously traversing our universe, coming from and going to a greater unknown universe surrounding it on all sides.

A pulsatory theory of gravitation would necessitate the extremely high speed of propagation previously indicated in order to obviate perceptible aberrational effects. This would, however, be provided for by the extremely small compressibility of the ether which is indicated by electro-magnetic considerations. The great wave-length necessarily assumed, since Leahy has shown that the attraction between two similarly pulsating spheres would be transformed into repulsion if their distance exceeded half the wave-length of the disturbance excited in the medium, would prevent sensible absorption in traversing any material bodies of the dimensions which would appear to be possible within the regions of space accessible to observation of gravitational effects.

The great wave-length and high speed of propagation would also prevent reflexion or refraction of

sensible amount. The hypothesis therefore appears to fulfil every condition as yet indicated by observation. Moreover, its provision for negative gravitational mass removes the limitation which would otherwise exist to the possible amount of matter in our universe. For if gravitational mass be necessarily positive, investigations by C. Neumann and H. Seeliger show that the presence of an infinite amount of matter in the universe would involve the impossible consequence of infinite values of gravitational force at some places in the universe; and Lord Kelvin, who also considered positive mass only, has assigned upper limits to the possible density of its distribution derived from the observed average speeds with which the stars are moving through space.

The alternative hypothesis, which is suggested by the fluidity which must necessarily be ascribed to the ether, is that gravitation is due to a steady hydrostatic pressure transmitted by it. Here the action would not be of the nature of radiation, so that no question would arise of aberration, reflexion, refraction, or absorption, and the speed of transmission would be conditioned only by the compressibility of the ether. Such a steady pressure might be produced by a slow continuous expansion of the electrons, or preferably by an expansion of the negative electrons and a contraction of the positive ones in such manner that the whole volume of the ether should remain constant. Such a process could not, however, continue indefinitely, as it would give rise to a continuous change in the constant of gravitation. It would have to consist of a very slow oscillation. The period of this oscillation might be extended to millions, or even thousands of millions of years, by ascribing a sufficiently high density to the ether, and we know of no phenomena which would determine an upper limit to this density. The turning-point of the oscillation would, however, have to come at the end of some period, and

the reversal of the expansions and contractions would give rise to a state of instability. The present state of the universe would therefore have to be regarded as merely a phase of an oscillation of long period in which matter is building up into stable forms, alternating with an equally long period of disintegration in which the visible universe would disappear by resolution into its constituent and invisible electrons.

The outflow and inflow of ether arising from expanding and contracting electrons respectively might, however, be produced in another way, which would not involve any such consequences, but would provide a solution corresponding in every one of the details already considered to that given by the pulsatory theory. It would, however, be necessary to assume that every electron in the universe is on the boundary which separates us from the greater universe of which ours forms a part, and that ether can flow in either direction across the boundary, although this is impassable to matter. In other words, our three-dimensional universe would have to be considered as bounded, not by a greater three-dimensional one, but by a four-dimensional one. It is impossible for us to form any physical conception of either kind of boundary, but a far more complete and satisfactory mathematical conception can be formed in the latter than in the former case, and its legitimacy is mathematically demonstrable. It therefore appears to me to be the preferable conception. Now suppose an ether flow to have been established, initially of equal amount through the nuclei of all positive electrons and through the nuclei of all negative electrons. Hydro-dynamical investigations by Lord Kelvin show that such a circulation once established in the perfectly fluid ether would continue permanently, unmodified by the motions of the electrons which would result from the forces called into play by the circulation.[1] Let us

[1] Except in so far as the motions might, by altering the shape

further suppose that the flow is either outwards or inwards respectively at all parts of our universe near enough to our solar system for gravitative interaction with our system to take place, and that at some very distant portion, beyond the reach of such action, the flow is inwards or outwards respectively. The effect would be that all bodies whose electrons were sources of inflow into our universe, and consequently of outflow relatively to the surrounding ether, and which might be called simply *sources*, would attract each other in accordance with Newton's law of gravitation under circumstances where this is found by observation to be accurate, and it has been shown [1] that small outstanding forces would also come into play of the character required to account for the observed astronomical anomalies. The same would apply to the distant bodies whose electrons were sources of outflow of ether from our universe, and which might be called *sinks*. If, however, any bodies whose electrons were sinks were near enough to bodies whose electrons were sources, repulsion instead of attraction would take place in accordance with the same law. The existence of negative masses would therefore be provided for, and as the flow would be twistless, it would give rise to no electric or magnetic effects, but to translational ones only, such as accelerating or retarding the velocity of light travelling with or against the flow. Gravitational action is, however, so minute in comparison with electric forces, and the density of the ether is so great, that any such effects would be far below the limits of our powers of observation. Since the steady ether-flow hypothesis does not provide for the neutral or weightless matter, the existence of which is indicated by the pulsatory hypothesis, the discovery of weightless matter in the universe would lead us to

of the nuclei, increase or diminish the circulation of ether through them.

[1] *Problem of the Universe*, p. 601.

abandon the steady ether-flow hypothesis, while if positive proof could be obtained that the existence of such matter is impossible it would lead us to abandon the pulsatory hypothesis. A more likely method of obtaining a criterion to decide between the two hypotheses would be by further mathematical investigation of the nature of the small forces called into play according to each hypothesis, when it might be found that one of them accounted more satisfactorily than the other for the observed astronomical anomalies.

We now see that the electron world-model has shown itself capable of correlating the whole complex of phenomena which constitutes the universe of what is commonly called inanimate matter, in so far as our present knowledge of this universe extends. In effecting this correlation we have derived invaluable aid from the concepts of the mechanical world-model which have served as the scaffolding around which we have built up the electron world-model. As the building of the second model progressed this scaffolding has had to be removed, piece by piece, as is always the way with scaffolding; and wherever the electron model appears to be approaching completion we find that the mechanical concepts have been eliminated. Nevertheless, in one sense, and that is an important one, the mechanical model may be regarded as remaining intact. It still suffices for the approximate representation of the broader features of observed phenomena, and has even been further developed, and rendered more capable of satisfactorily representing these broader features, or mechanical phenomena, as they may be called, in consequence of suggestions derived from the growth of the second model. In this second model even the principle of the Conservation of Energy, which was fundamental in the mechanical model, seems to be disappearing, together with the rest of the scaffolding, and having

its place occupied by the principle of the Dissipation Energy. As Sir Joseph Larmor observes[1]:

"The effect of admitting a molecular synthesis of dynamical principles such as the one here described [the electron model] is to depose the conception of energy from the fundamental or absolute status that is sometimes assigned to it; if a molecular constitution is fundamental, energy cannot also be so. It has appeared that we can know nothing about the aggregate or total energy of the molecules of a material system, except that its numerical value is diminished in a definite manner when the system does mechanical work or loses heat. The definite amount of energy that plays so prominent a part in mechanical and physical theory is really the mechanically available energy, which is separated out from the aggregate energy by a mathematical process of averaging, in the course of the transition from the definite molecular system to the material system considered as aggregated matter in bulk. This energy is definite, but is not, like matter itself, an entity that is concerned in unchanging amount; it merely possesses the statistical yet practically exact property, based on the partly uncoordinated character of molecular aggregation, that it cannot spontaneously increase, while it may and usually does diminish in the course of gradual physical changes."

If the dissipation of energy is compensated throughout the universe, then the principle of the conservation of energy will necessarily apply to the universe as a whole. The question whether such compensation is probable or even possible without the introduction of agencies foreign to the nature of the model we are considering is therefore one of the most paramount interest and importance. J. H. Jeans has shown[2] that if it were possible to form what we might call an

[1] *Æther and Matter*, p. 286.
[2] See *Problem of the Universe*, p. 295.

ideal matter, built up of electrons, the electric charges of which were either larger or smaller than those which form the basis of matter as known to our experience, and to make a mixture of ideal matter and ordinary matter, then the ordinary law of energy dissipation might be largely modified. The dissipation might, for example, be partially compensated. We have no evidence whatever which would even suggest the existence of such matter. Nevertheless, it is of interest to ask the question whether, if it did exist anywhere within the universe, or if it could be formed by any action taking place anywhere in the universe, would it be possible to obtain complete compensation throughout the universe as a whole? Jeans has obtained a very complete answer to this question by the solution of a more general problem of which this is only a special case. He has shown, by an investigation based entirely on the fundamental principles of energetics, that it is of mathematically infinite improbability that any universe containing molecular matter should constitute a conservative system, that is to say one in which all actions are reversible.[1] The demonstration applies to any universe containing any kind of molecular matter, not necessarily electron matter, not even necessarily matter associated with ether at all; and proves that any such universe must, in the absence of action outside the laws of energetics, ultimately pass into the state of changelessness which has been called physical death. Since the demonstration proves the infinite improbability of any return, by its own external actions, from the state at any given time towards the initial state, it shows it to be infinitely improbable that the initial conditions should be the result of any internal action. In other words, it is of mathematically infinite improbability that a universe containing molecular matter, as our universe certainly does, should be self-

[1] See *Problem of the Universe*, Appendix K.

maintaining or self-formed. No practical distinction can be drawn between absolute impossibility and the practical impossibility expressed as infinite improbability. Nevertheless, we shall see in chapter iv that the fact of the solution being obtained in the latter form is of the most fundamental importance in the attainment of a true conception of the system of nature.

I now have to justify the title of this chapter by showing how the electron world-model can be established on the sole basis of energy. We have seen that the basis of matter, as far as matter is in any respect accessible to our observation, is the formless ether, in which as yet no strain-forms exist, but which is imbued with energy of spin in every smallest portion into which we could, by the utmost stretch of our imagination, conceive it to be divided. That is to say, ether which, though as yet formless, is prepared for the formation of strain-forms as soon as the requisite formative power shall come into action. In the formless state the energy of spin constitutes a uniform volume, or spatial, distribution. Let us now take, in imagination, the one further step conceivable, and suppose this uniform distribution of energy to be abstracted. Nothing can remain but an absolutely quiescent ether containing no energy. It is impossible for us to form any conception of such a substance, for it would have no properties by which its presence could become known to us, these properties arising entirely from the energy distribution. It therefore has no phenomenal existence; whether or not it exists in a metaphysical sense, as a vehicle for carrying energy, we have no means of determining, for it can have no part in any known natural phenomena, all of which are due to changes in energy distribution. That is to say, energy is the sole ultimate phenomenal basis of matter.

It may appear to some readers a lessening of the reality of matter to find its foundation in the abstract

concept of energy. A moment's reflection will, however, convince them of the falsity of such a point of view. The scientific concept of matter, as I have endeavoured to present it, is quite as abstract as that of energy, and of far greater complexity. Moreover, the results of additions of energy to material bodies, subtractions of energy from them, and changes in energy distribution are every whit as immediately perceptible as the material bodies themselves. They do not present themselves to an untrained mind as mere manifestations of energy, but neither do various substances, for example, bread, water, milk, coal, and air, present themselves to it as having certain common properties in virtue of which they may be grouped together as material bodies. The aggressive burglar shot in the leg would not recognize in the stopping power of the bullet an addition by the explosion of the powder to the constitutive energy of the bullet in virtue of which it is a bullet; but he would not fail to recognize the stopping power which it had acquired. The blue-jacket on a polar expedition, who lost the skin from his fingers by incautiously handling bare metal, would not appreciate the fact that heat energy had been withdrawn at an unduly rapid rate from his flesh; but he would be more cautious in the future. A lighted fusee dropped upon the hand of an unscientific friend would not fail to excite a protest because he did not grasp the fact that a portion of the constitutive energy of the fusee was being transformed into a state in which his hand could assimilate it too rapidly for his comfort. No; there is no loss in reality, but a great gain in simplicity when energy is recognized as being the essential basis of matter.

The concept of the total energy of a system, and the principle of its conservation in any isolated system, have, as we have seen, been deposed from the commanding position which they occupied in the mechanical representation of the universe. Although the principle of

the conservation of the total energy was propounded as a probably valid generalization from experience, it was, as we have seen, found to be a necessary consequence of the assumption that the mechanical model formed an adequate representation of inanimate nature. The recognition of the fact that the mechanical scheme is only a first approximation to the representation of observed phenomena, and the consequent development of the second model, or second approximation to a complete representation, have shown that we cannot hope ever to establish upon an observational basis the validity of the principle of the conservation of the total energy in any more fundamental sense than as an approximate representation. Yet in a theoretical sense it has acquired an even more fundamental significance than it possessed in the mechanical scheme. For we now see that the total energy of a dynamical system is its sole ultimate phenomenal content, so that a denial of its complete conservation would involve either the decrease of the content by the annihilation of a portion of it, or the increase of the content by the creation of an additional portion. It would, however, be impossible to apply the methods of physical investigation to a system liable to have its substance increased or diminished by creation or annihilation respectively, so that the physicist is compelled to assume the conservation of the total energy of any isolated system as an essential condition of its being amenable to physical investigation. These considerations show conclusively that either to assert or to deny such a proposition as that the principle of the conservation of energy applies to the whole universe, is to forsake the domain of science for that of pure guesswork; and this applies to the assertion or denial of any proposition respecting the universe as a whole. Such assertion or denial would necessarily transcend the limits of our experience, and would therefore be essentially unscientific.

We are now in a position to determine exactly what we are entitled to assert, as the result of scientific research, with respect to the possibility of either self-maintenance or self-origination of the universe visible to the astronomer.

1. The phenomena of energy dissipation, as revealed by terrestrial observations, demonstrate the existence of irreversible actions which, unless compensated in other portions of the visible universe, would make its self-maintenance or its self-origination practically impossible, except through the presence of activities other than those represented in the energy model dealt with in this chapter.

2. In so far as the visible universe consists of molecular matter, or of molecular matter and ether, such compensation is practically impossible except through activities which are not accounted for by the dynamical principles, or laws, as they are called, which form the bases of all physical investigation.

3. The spectroscopic examination of the light omitted by stars of all magnitudes down to the twentieth, shows that molecular matter is or has been present, for at least twenty-eight million billion years, throughout the visible universe contained within a sphere with the earth as centre and having a radius of at least twenty-eight million billion light years, and that during this period of twenty-eight million billion years, there have been no such changes in dynamical laws as would be indicated by a difference in the radiation originating at the beginning of this period and that originating recently from the nearer stars.

We are therefore entitled to draw the conclusion, based on experience extending throughout these limits of space and time, that the sidereal universe can be neither self-maintaining nor self-originating except in virtue of activities which are included neither in the mechanical model nor in the energy model. The

necessity for a further model including such activities is therefore indicated, and I shall endeavour to show in chapter iv how it may be constructed without any deviation from the path of observational experience which we have hitherto followed. When we have constructed this third model, we shall find it capable also of accounting for the phenomena of life and for their origin, a problem which has never been brought within the scope of the energy world-model.

CHAPTER IV

THE MIND WORLD-MODEL

SUMMARY

A further inquiry into the nature of the phenomena which the energy model fails to represent shows that the foundation of the third model must consist of an activity possessing the known characteristics of human reason and the power of controlling the distribution of energy.

The existence of such an activity is therefore assumed as a working hypothesis, and is called the Universal Mind.

A comprehensive provisional definition of mind is given in terms of observed characteristics of living organisms, and is shown to be justified by the unification, by means of the working hypothesis of the Universal Mind, of the characteristics involved.

The mutual interaction between the human mind and the human brain, which is universally accepted by common sense, is shown to be as firmly established as any scientific conclusion can be, in that its denial would involve, not only the invalidation of the whole procedure of physical science, but the conclusion that the universe is a chaos and not an ordered system. It follows from the reality of this interaction that the human mind possesses the capacities of exercising control over, and of being affected by, changes in energy distribution.

The hypothesis of the Universal Mind, therefore, accounts satisfactorily for the building up of the inanimate universe from its initial energy content, however this energy may have been initially distributed.

The observed continuity of the physical laws of the energy-model throughout non-living and living matter, together with the observed capacity of every organism of reproducing life of its own kind, is shown to lead to the conclusion that the hypothesis of the Universal Mind accounts satisfactorily for the nature and origin of life.

The physical legitimacy of the concept of the Universal Mind is demonstrated by showing that the correlation of the minds of all known organisms into a single unity is a necessary consequence of accepted physical data.

The essential limitations of the mind-model are indicated, together with the additional limitations resulting from its incompleteness.

It will be my endeavour in this chapter to show how the third world-model, the necessity of which was indicated in the preceding lecture, may be constructed by means of a procedure in every way similar to that employed in the construction of the two earlier models.

The foundation of the first, or mechanical world-model, was the hypothesis of Sir Isaac Newton which found its expression in the law of universal gravitation. The confirmation of this hypothesis by experience, suggested its tentative extension to other branches of physics, and so successful were these extensions, both in accounting for a wide range of observed phenomena and in predicting phenomena hitherto unobserved, and which owed their subsequent discovery to the search for them which had been suggested by purely theoretical deductions from these hypotheses, that the mechanical world-representation was for a considerable period regarded by many physicists as one which might possibly admit of development into an adequate representation of the whole of nature.

The second, or energy world-model, was based on the conception of the molecular nature of matter indicated by observed chemical phenomena, and on the conception of a medium capable of transmitting the mutual actions of the molecules which were indicated by observation. The development of this second model, in its later and more advanced stages, compelled us to abandon some of the fundamental concepts of the mechanical model. Nevertheless, this first model was left standing in its entirety as the simplest and most convenient method of representing the first approximations which alone were requisite for correlating the broader and more outstanding features of inanimate nature. These broader features were still most simply represented and dealt with as mechanical phenomena in the first place; that is to

say, so long as a first approximation only was the object aimed at. In fact, during all the earlier stages of construction of the energy model, the process could be and was regarded simply as an elucidation of the details of the parts of the first model. It was only at the latest stages in the construction of the second model that portions of the first model began to assume the form of scaffolding which must be removed before the second model could be completed.

In constructing the third model I shall proceed on the same lines, and regard it as underlying the second model in the same way that the second model underlies the first. As in the earlier constructional stages of the second model it appeared only as supplementing, and not as modifying the nature of, the first model, so it will be in the third model, which will make its appearance as supplementing the second model merely, not as modifying its nature.

The first step, the requisite working hypothesis, is indicated by a consideration of the nature of the demonstration that both the eternal existence, and its only possible alternative, the self-origination in time, of a universe containing molecular matter are infinitely improbable, provided that the only activities present are those included within the scope of the energy model; that is to say, provided that the existence of activities beyond the scope of dynamical principles is excluded. The mathematical demonstration itself is of a high order of difficulty, but all that we are now concerned with is to obtain a clear apprehension of the nature of the activity involved, and of the overwhelming strength of the evidence of its presence in our universe. The first point to be clearly grasped is the meaning of the expression *mathematically infinite improbability*, and a simple illustration will make this plain. Suppose I ask the question: What are the odds against a selected card,

say the ace of spades, being drawn when a card is taken at random from the pack? Since there are fifty-two cards in the pack, any one of which is equally likely to be the one drawn, it is clear that the odds will be 51 to 1 against the selected card, for there are fifty-one opportunities of drawing a wrong card and one of drawing the right one. Another way of expressing the result is to say that the probability of drawing the selected card is $\frac{1}{52}$, and the probability of drawing a wrong one is $\frac{51}{52}$. To determine the probability of drawing a selected card twice in succession, either from two packs or from the same pack reshuffled, is clearly

$$\frac{1}{52} \times \frac{1}{52} = \frac{1}{2704};$$

for the number of first-drawings giving the selected card will average one in fifty-two of the whole, and the selected card will be drawn the second time in one out of every fifty-two successful first drawings.

The probability of drawing the selected card ten times in succession would evidently be represented by a fraction with unity as numerator and with the number obtained by multiplying fifty-two by itself ten times as denominator, and so on for any number. The odds would be enormous against even a succession of ten, yet there would be no theoretical impossibility in the selected card being drawn say a thousand, or a million, or a billion times in succession, and as long as the number of successive trials remained a finite number, however large this might be, the odds against continuing to draw the selected card for the given number of times would always be represented by a finite number. We could only reach an infinite mathematical improbability in the case of the expectation considered being that of an infinite number of successive drawings of the ace. Yet if some card-trick performer made such a selection successfully even a hundred times in succession, we should feel perfectly certain that he was not drawing the cards at random,

but was consciously selecting the card he desired by some means which we were unable to distinguish. That is to say, the very moderate odds, comparatively speaking, against successfully drawing the card 100 times in succession without conscious selection would be regarded as a sufficient basis for practical certainty that such a series of successes had not been obtained by purely random drawings, but that some trickery had been employed through which conscious selection had been brought into play. Still more would this be the case for a thousand, a million, or a billion successions. Yet none of these would even approach to mathematically infinite improbability. In fact, it is very seldom indeed that any evidence which we speak of as certain approaches to mathematically infinite probability. It follows, therefore, that I am justified in using the terms practical impossibility for mathematically infinite improbability, and practical certainty for mathematically infinite probability. Yet even the drawing of the selected card an infinite number of times in succession would violate no natural law, and this is the importance of the distinction between practical and theoretical impossibility in the case of the eternal existence or self-origination of the universe. Theoretical impossibility would mean that either of these alternatives would involve a violation of the dynamical principles, or natural laws, on which the energy world-model was founded. The eternal existence or self-origination of the universe would violate no natural law, yet the odds against either are infinite; that is to say, they are greater than could be expressed by any finite number, however great this might be. As, however, one or other of these two practical impossibilities must be true, the solution suggested, as in the case of the card-drawing, is that the activity for which we are seeking is a conscious, intelligent activity exercising purposive selection.

I have purposely chosen a very simple example

admitting of numerical evaluation for a series of any desired extent by means of the simple arithmetical process of repeated multiplication. Before making use of the suggestion which it presents to us, and proceeding to seek further evidence of the existence of purposive activity in nature, I will endeavour, by means of some further examples, more obviously corresponding to the conceptions lying at the foundation of the energy world-model, to indicate something of the nature of the purposive activity requisite to account for one or other of the two possible alternatives—the eternal maintenance of the visible universe or its origination at some remote instant of time.

Let us picture to ourselves a great and panic-stricken crowd pressing closely upon one another in a tumultuous rush down a steep and narrow defile bounded by rocky walls. To an onlooker upon the hill-side it would appear absolutely impossible, perhaps indeed hardly even conceivable, that the strongest and most determined man could succeed in passing upwards through the defile during the continuance of the downward rush. Yet careful observation would soon reveal the continual recurrence, almost everywhere throughout the crowd, of eddies in the descending torrent of people, by which small groups were being momentarily carried backwards and upwards, after which their downward progress would be resumed. If endowed with the gift of scientific imagination, the onlooker might well picture to himself the possibility of a man threading his way upwards through the descending crowd, with very little personal exertion, provided he were endowed with such powers of observation and prevision as would enable him to utilize these eddies to the utmost. He might further picture to himself some external power transferring one of the units of the crowd who had nearly reached the bottom of the defile back again to the top, by very slightly modifying the distribution of the eddies in position

and in the times of their recurrence, without any change in the general character of the downward flow. As these eddies were already partly controlled by the purposive activities of the members of the crowd, this would not involve the introduction of any new type of agency. We shall see presently that such purposive direction is possible without any infraction of the observed dynamical laws in accordance with which the energy model was constructed.

An illustration altogether within the scope of the energy model is afforded by the complex system of eddies which may be observed in the rapids of many rivers and streams. It would be theoretically possible, though so improbable that it might be regarded as practically impossible, for a floating chip of wood to be carried by a succession of the eddies from the foot of the rapids to its head. It would, however, in many of these rapids, be a simple matter for a fish to pass up them without sensibly exerting its power of swimming against the stream, merely by utilizing a suitable series of eddies, but this introduction of purposive action would, of course, extend the illustration beyond the limits of the energy model.

These simple illustrations will help us, in spite of their crudity, to the understanding of a simple dynamical system the stability of which can be investigated by a method exactly similar to that employed in determining the conditions of stability of the whole visible universe.

Suppose a pot of cold water to be suspended over a fire. For simplicity in the argument, suppose the fire to consist of a horizontal incandescent surface of uniform temperature and considerable extent, with its centre vertically below the centre of the pot. Under these conditions the flow of heat may be considered as being vertically upwards and uniform in amount in the neighbourhood of the pot. Let the pot, the incandescent area vertically below it, and the

gases conveying the heat between the fire and the pot be taken as the dynamical system to be considered. We know from experience that the fire will lose heat and the pot of water will gain heat. The transference of heat from the fire to the pot will consist in a decrease in the energy of motion of the molecules of the incandescent material constituting the fire, and an increase in the energy of motion of the intervening gaseous molecules, and of the molecules of the pot and of the water contained in it. This will be effected, almost entirely,[1] by collisions between the molecules of the incandescent material and the gaseous molecules in immediate proximity to it, and the increased energy of motion of the gaseous molecules will be transferred vertically upwards by a series of collisions between the molecules. Now imagine the space between the fire and the pot to be divided into a large number of slices by planes parallel to the incandescent surface. Then, if it were possible to withdraw any one of these slices and submit it to experimental observation, we should find that the temperatures of the slices were greater the nearer they were to the incandescent surface, showing that the vertical flow of heat across them from the fire to the pot was accompanied by a steady fall in temperature exactly corresponding to the steady fall in level which corresponds to a flow of water at uniform speed down an inclined bed. The heat falls from a higher to a lower temperature just as the water falls from a higher to a lower level, and Lord Kelvin has shown that the flow of heat in all bodies, whether solids, liquids, or gases, must be accompanied by minute eddies corresponding to those observed in the flow of water. The representation, in the energy

[1] The radiation from the fire to the bowl is so small as to be practically negligible, as can easily be shown experimentally by attempting to boil the water by suspending the bowl in front of the fire instead of above it.

model, of the flow of heat through the gases intervening between the fire and the pot is that it consists of a transference of energy by collisions between the gaseous molecules, so that the average speed of the molecules in any slice would be smaller the greater its distance from the incandescent surface of the fire. If the intervening medium were liquid or solid, the only difference in the mode of transmission would be that in a liquid the freedom of motion of the molecules would be less than in a gas, owing to their closer packing and greater interaction. In solids the freedom of motion would be still further diminished. Lord Kelvin's mathematical investigations prove that, while any possible observation of the flow of heat in a solid, liquid, or gas would show a steady fall in the temperature from the hot side to the cool side, yet, if our powers of observation were as delicate as our mathematical analysis, so that we could follow the flow of heat along the finest threads, so to speak, of the material, then in proceeding along such a thread in the direction of falling temperature we should find, at some points and at some instances, forming an infinitesimally small proportion of the whole, that we were passing from more slowly moving to more rapidly moving molecules, indicating the existence of a backward heat eddy.

The mathematics show that if the experiment of placing a vessel of water over or upon the surface of a fire could be repeated an infinite number of times we might expect that, on a very few occasions, forming an infinitesimally small proportion of the whole, there might be such a massing together of the eddies as would reverse the flow of heat, so that the water might freeze and the fire become hotter. They also show the possibility that the massing might be so adjusted as to result in no flow of heat, but that this would be far more improbable than the freezing of the water when placed on the fire. The

probability of either of these events occurring in any finite number of trials would, however, be infinitely small, even if every man, woman, and child on the earth's surface were imagined to have been engaged in making such observations continuously ever since mankind have existed on the earth. Even if this could be continued for billions of billions of years, by as many persons as now exist on the earth, the expectation of either result would still be infinitesimally small. The ordinary observed case of the fire losing heat and the water gaining it corresponds to the observed dissipation of energy prevailing throughout the visible universe, and carrying it through a series of changes beginning with a maximum availability of the energy contained in it, or rather, as we should say from our present point of view, a maximum availability of the energy constituting it, and tending towards an ultimate state of physical death, when the energy, by attaining a uniform distribution, will have become completely unavailable for the production of mechanical work. The case of the freezing of the water would correspond to the self-origination of a state of maximum availability from a state of less availability. Finally, the case of no flow of heat, in either direction, between the fire and the water, would correspond to the eternal existence of the universe. The mathematical investigation, being of exactly the same character in the case of the whole visible universe as in the case of the fire and the pot, entitles us to make the statement that the self-origination of an initial state of increased availability of energy in the visible universe is as impossible as the freezing of a pot of water placed upon a fire, and that the eternal existence of the visible universe, involving a continued maintenance of the available energy, is even more impossible.

I am now going to attempt to translate the mathematical procedure itself into conceptions which can be grasped even by minds which have never had the

advantage of mathematical training; and although this translation will not make it possible for them to form any independent judgement on the validity of the procedure, it will exhibit so much of its general character as greatly to increase their insight into the nature of the problem which we are considering and of its solution.

Consider, in the first place, a single particle, that is to say a body so small that it may be regarded, without sensible error, as concentrated at a single point, and let us suppose, to start with, that we are concerned only with the position, and not with the aspect, of the particle at each instant. The sequence of the changes of such a particle can consist only of changes in position. Moreover, for our present purpose, the question of the rate at which these changes follow each other in time does not concern us. The whole sequence of changes in such a particle, as far as they concern our present purpose, will therefore be completely represented by a curve in space drawn through the successive positions of the particle, and this curve must be a continuous one, since a material particle cannot jump from one position to another without passing continuously through a series of intermediate ones. Suppose the particle, as it is describing this curve, to be free to move in any direction from the position occupied by it at any instant; then, as we have no means of predicting its motion, we must regard every possible direction as equally probable. The number of such directions is obviously infinite in every position of the particle; but though any infinite quantity is greater than any possible assigned quantity, however great, yet there are different orders of infinite quantities, as we can easily see by supposing for a moment that the motion of the particle is confined to a plane, when it would still have an infinite number of directions open to it, though this infinite number would only form an infinitesimal proportion of the

number which would be open to a particle able to move freely in space. I think the simplest way of taking this into consideration is to say that the particle constrained to move in a given plane would have two mutually perpendicular directions of motion open to it, together with all intermediate directions; and that the particle moving freely in space would have three mutually perpendicular directions of motion open to it, together with all intermediate directions. In the former case, two numbers, called co-ordinates, are required to specify the position of the particle, and the mathematician would call the space in which it is free to move a space of two dimensions. In the latter case, three co-ordinates are required, and the space would be called a space of three dimensions. If the aspect of the particle, that is to say the direction in which any specified portion of it faces, is to be taken into consideration, three more co-ordinates, making six in all, are required to completely specify its position. The sequence of changes in position could therefore no longer be determined by the succession of points on a curve drawn in space, since every such point is determined by three numbers only in place of six. If, however, it were possible to construct in imagination a *generalized space* in which a point could move in any one of six mutually perpendicular directions, or in any intermediate direction, then the sequence of changes in the particle could be completely represented by a curve in such a space, a *generalized space* of six dimensions, as a mathematician would call it. Now it is impossible for us to form any direct mental representation of a *generalized space* of even four dimensions, though mathematicians have been able to work out the geometry of such a space, and have proved beyond all question the legitimacy of mathematically constructing a space of any number of dimensions whenever it may provide a useful aid, as it frequently does, in

the arrangement of the thought-process which is known as mathematical analysis. The inference to be drawn in this case is that the point whose motion along a curve in a generalized space of six dimensions represents the sequence of changes of a single particle in position and aspect, has an infinitely greater choice of directions than the point on a curve in ordinary three-dimensional space which represents the sequence of changes of the particle in position only. This reasoning may be extended step by step, first to two particles, whose sequence of changes may be represented by a *representative point* moving in a generalized space of twelve dimensions, and so on, up to a system containing any number of particles. And these particles may be any smallest particle capable of separate existence in the dynamical system which may be under consideration. In the problem of the fire and the pot the separate particles concerned would be molecules, or small groups of molecules. The representative point in this case would have to be regarded as moving in a generalized space of six times as many dimensions as there were particles in the system consisting of the fire, the pot, and the gases and solid bodies participating in the process of heat transference from the fire to the pot. In order to take the ether, as well as the matter, of the system into consideration, we should have to increase the dimensions of this generalized space; that is to say, increase the number of mutually perpendicular directions of motion open to the *representative point* by twice the number of possible distinct modes of vibration of the ether concerned in the problem in question. In extending the method to the whole visible universe the *representative point* would have to move in a space of six times as many dimensions as there are distinct particles in the universe, together with twice as many dimensions as there are distinct modes of ether vibration. We know very

little about the latter quantity except that it is incomparably larger than the former. All that concerns us, however, is to recognize the inconceivable infinity of directions open at any instant to the *representative point* of even so simple a dynamical system as the pot boiling over a fire. If there were no interchange of heat between the fire and the water the system would be a stable one, and the representative point would follow continuously what we might call a *level path*. In that case there would be neither decrease nor increase in the ratio of the available energy to the total energy of the system. But stability might also be attained by a motion of the representative point fluctuating about a level path, sometimes taking the downward grade corresponding to a decrease in the available energy, and correcting its descent by corresponding deviations into an upward grade path, which would tend to cause a return of the system to its initial state at the first lighting of the fire, when the available energy was a maximum. What we have to bear in mind, however, is that, as the mathematical investigation demonstrates, in every position of the representative point an infinite number of downward grade paths are open to it for every level or upward grade path. The system could, therefore, neither maintain itself as a conservative one by following an average level path, nor return towards its initial state by following an average upward grade path, except by taking an infinitely improbable direction at every instant with the exception of, at most, an infinitely small proportion of the whole number of instants in the path. The point would, in fact, have to thread its way through a labyrinth in which at every turn an infinite number of downward grade ways were open to it for every level or upward grade way. Yet it would have to take a level or upward grade way more often than a downward grade one.

In the case of the fire and pot system the repre-

sentative point is always found to follow a downward grade path, corresponding to dissipation of the available energy. In the case of the whole visible universe the only difference in the representation is in the immensely greater complexity of the generalized space in which the representative point moves. But if we extend our consideration to the whole past history of the representative point we find that it must either have followed an average level path or, if now moving on a downward grade path, as the observed dissipation of energy, wherever observation is possible, appears to indicate, it must, at some past time, have followed an upward path, provided the past history of the universe is to be accounted for by activities existing within it. The only possible alternative to these two would be that the initial state of the universe originated in some activity altogether outside it, and whose presence is therefore not to be detected within it. This was the solution which found its expression in the Deism of the eighteenth century. An external activity, of which no manifestations are to be observed within the universe, must necessarily remain for ever inaccessible either to the observations or to the reason of man, constituted as he is at present, and to seek refuge in such a solution before exhausting every resource in the search for a solution by means of activities existing within the visible universe would be to abandon completely the standpoint and the procedure of scientific inquiry. We may therefore put this solution aside as a last resort, to be considered only in the event of our failure to find any evidence within our experience of the presence of such activity as is requisite for a solution of the problem.

Returning to the consideration of the representative point whose path represents the sequence of changes in the inanimate universe, let us for a moment imagine ourselves capable of watching its motion while following either a level path or one which has

an average upward trend, and of knowing whether the path being followed at each instant is a wrong one; that is to say, on the downward grade; or a right one, that is to say, either a level path or one on the upward grade. As we observed it from instant to instant, moving inerrantly among the infinite possibilities of error at every point (and this it must do if the solution is to be found in an activity manifested within the visible universe), it would be impossible to avoid the conclusion that some invisible intelligence must be guiding it on its way. That an unintelligent activity should enable it to thread a labyrinth, when at every point there were an infinite number of wrong paths to every right one, would be absolutely inconceivable.

The activity indicated is therefore conscious, purposive intelligence, and before seeking for the evidence of such intelligence within the limits of our experience, I would again call attention to the fact that all the possible paths, whether right or wrong, as I have called them, are paths open to the representative point moving in accordance with the dynamical laws to which it is subject, the observed laws of ether and matter which are found to govern all the changes in the material universe. The possibility of such a representation therefore proves the compatibility of such guidance with the observed laws of nature. Moreover, since the combination of human intelligence which is crystallized in modern mathematical analysis is capable of constructing so simple a model as the guidance of a point along a path to illustrate the guidance of the whole material universe by the supreme intelligence, it is no longer possible to maintain that the conception of such guidance is entirely beyond the grasp of the human mind.

Such continuous guidance is here shown to be necessary only while the representative point is moving along a level path or one on the upward

grade; that is to say, only so long as the available energy of the whole universe remains constant in quantity, or is increasing. It might be withdrawn during the present stage of existence of the visible universe if, as is suggested by all available experience, the available energy is at present decreasing in amount, and the representative point therefore on the downward grade. To assume, however, that the guidance which must necessarily have been exerted at some period in the history of the universe has now been withdrawn, would be entirely gratuitous, and therefore unscientific. What has been definitely proved so far is, that unless we fall back upon the deistic solution, such continuous guidance, which is in conflict with no observed law of nature, *must* have been exercised in the past, and *may* be exercised at present.

Now we learned in chap. iii (p. 93) that energy is the ultimate phenomenal basis of matter and ether, so that all the changes in the material universe are energy changes. If, therefore, the energy of the visible universe is neither being created nor annihilated, all material changes therein are simply changes in the distribution of its energy. It follows then that, in the absence of creation or annihilation, the only powers which must necessarily be possessed by the guiding activity are the power of changing the distribution of energy throughout the universe and the intelligence requisite to the attainment of the observed results by the purposive application of this power. This is both a confirmation and a generalization of Maxwell's demonstration of the possibility of compensating the dissipation of energy, without any interference with the laws of nature, by the application of intelligent purposive guidance to molecular motions.[1]

The representation at which we have arrived shows that this intelligent purposive guidance must be

[1] See *Problem of the Universe*, p. 234.

applied both to the material particles distributed throughout the universe and to the all-pervading ether. The working hypothesis indicated is therefore the existence of an intelligent purposive activity pervading the whole visible universe, for wherever ether or matter are this activity must be present. It must possess the power of controlling the distribution of energy to the extent requisite for the attainment of the end actually found by observation to be attained, and sufficient intelligence so to exercise this control as to attain that end. And this end must, in consequence of what has already been demonstrated, be nothing less than either the maintenance of the visible material universe as a conservative system or its building up from an energy distribution out of which it could not be developed spontaneously.

Now the capacity of thus positing an end and intelligently directing action towards the attainment of that end is a perfectly familiar one, being an observed characteristic of all conscious life, and attaining its highest observed development in human reason. The human reason will therefore be an activity possessing powers of the nature required, although to a much lower extent than would be requisite for either the guidance or the building up of the universe, provided it can be shown to possess the power, in however small a degree, of controlling the distribution of energy.

Now we know from observation that this power is possessed by the human reason, for man is able to effect changes in his material environment, and we have seen that all material changes are nothing else than changes in the distribution of energy. Moreover, this power of purposively controlling its material environment is characteristic of every living being, conscious or unconscious, as Herbert Spencer has shown[1], and he therefore defined the criterion of life

[1] *Principles of Biology*, vol. i, p. 74.

as a capacity "for the continuous adjustment of internal relations to external relations".

I shall therefore employ the term *Universal Mind* as the designation of the omnipresent intelligent activity, the presence of which in the visible universe is to be assumed as our fundamental working hypothesis, and I shall use the word mind in its widest possible signification as denoting *the basis of all the phenomena of consciousness in man and the higher animals, and of all those purposive actions which enable the lower as well as the higher organic forms to modify the relations between themselves and their material environment.*

In so defining mind, I am making the assumption, which must be subsequently justified by the test of its agreement with observation, that the power possessed by even the lowest organisms of modifying their material environment to their own benefit has the same essential basis whether it be consciously directed by the organism or not. My own consciousness provides me with the most direct and convincing evidence possible that I possess this power of purposive action, of action directed towards the attainment of an end, and that such action is consciously directed by my will. All my experience of the actions of other men leads me to the conclusion that this testimony of my own consciousness is common to all mankind, for all men of sound mind act on the conviction that they are capable, to a greater or lesser extent, of consciously guiding their actions by means of the will. Those who do not so act we call imbeciles. They are found to be incapable of the actions requisite to the continuance of their life without assistance from others. Nevertheless, thinkers of the materialistic school, which, although it is now practically extinct, had many adherents until quite the end of the nineteenth century, denied the purposive character of human action, denied that human action

was guided, even to the smallest extent, by human consciousness. They were compelled to do this if they were to continue to retain their belief in the hypothesis that all the phenomena of the universe, including man himself, were completely expressible in terms of the mechanical model. An occasional belated survivor of this school is still to be found, however, with a considerable sprinkling of the uninstructed exponents of popular science who supply aspiring but untrained minds with what passes for science. We must not, therefore, remain content with the direct evidence of consciousness alone, but must inquire whether any alternative would be admissible.

The science of physics, in which I include physiology, the physics of living matter, leads to the conclusion that all changes in consciousness are accompanied by changes in the grey matter of the brain; and that certain changes in the grey matter of certain portions of the brain are, conversely, under normal conditions, invariably accompanied by changes of consciousness. In all observed cases of this concomitance of mental and material phenomena, every stage, except one, of the relation has been more or less completely accounted for in terms of the concepts either of the mechanical or the energy model; that is to say, in terms of physical science. The one exception is the relation between the brain changes and the changes in consciousness; that is to say, the relation between mind and matter. This relation is very generally regarded as a problem which must ever remain unsolved by physical science, and if the scope of physical science were to be restricted to the mechanical model and the energy model, this would necessarily be the case if our previous conclusions are justified. We have seen that the problem of the relation between mind and matter can be transformed into the simpler one of the relation between mind and energy. Moreover, the concept of mind has not

presented itself as within the scope either of the mechanical model or of the energy model. The latter model appears to be capable of adequately correlating all our experience of the visible inanimate universe as a system existing at the present time. The concept of mind made its appearance only in the course of an inquiry into the possibility of the origin in time of this universe or, alternatively, into the possibility of its constituting a permanent system which always has existed and always will exist. Mind is, therefore, essentially outside the scope of either of the first two models. Its correlation with the energy model can therefore be effected only by the construction of a third model, and what I am now endeavouring to show is that such a model can be constructed without deviating in any respect from the procedure of physical investigation which gave us the first and second models. The correlation of mind and matter will then be effected by extending the scope of physical investigation beyond the limits of the energy model. Now we have seen that the mechanical concepts of the first model, and even the quasi-mechanical concepts derived from them, although they proved useful as scaffolding to guide us in the earliest stages of construction of the energy model, had to be removed as hindrances as the latter was developed. Every trace of such concepts had been eliminated before the seemingly bewildering complexity of the second model became resolved, through the fusion of its apparently diverse elements into unity, into the grand simplicity of energy in its various manifestations.

The concepts which formed the foundations of the energy model were molecules as the structural elements of matter, and ether as the connecting medium through which interaction of the molecules was made possible. As the construction of the model advanced these two apparently distinct concepts became merged into one through the molecules being shown to consist

simply of structures in the ether. Finally, the essential basis of the ether was found to be the substance [1] already known to observation as energy.

The concepts which form the foundations on which the mind-model is to be constructed are: the purposive activity requisite to account for either of the two possible alternatives, the existence of the visible universe as a conservative system without beginning and without end, or its origin in time; the purposive activity observed in the lower organisms and which we are unable to regard as being consciously directed by the organisms themselves; and, finally, the consciously controlled purposive activity of man and the higher animals. The construction of the mind-model and its establishment as an adequate representation of the observed phenomena of the universe will be effected if I can show that the hypothesis of Universal Mind is capable of unifying these three concepts and of satisfactorily accounting for those features of inanimate and animate nature for which the first two models have failed to provide an adequate representation. The three fundamental concepts of the mind-model have one common characteristic, that of purposiveness; so that we find at the outset a suggestion of possible unification which was entirely absent in the case of the original concepts which formed the foundations of the energy model. We saw, however, that the activity of the Universal Mind must be more than purposive: it must possess, in a very greatly enhanced degree, the powers universally attributed by the consciousness of mankind to human reason of directing its modifying action upon the universe, as

[1] The term *substance* is here employed, not in its popular sense as signifying a portion of matter, but in its fundamental philosophical sense (which is also its etymological sense) as that which sub-stands, or underlies, all phenomena. Energy corresponds to the *prima substantia* assumed by scholastic philosophy, so that modern physics confirms the validity of the assumption.

represented in the energy model, towards the attainment of remote ends which we can imagine as represented only by concepts of far greater generality than anything directly attainable by the human reason. We found that the ultimate concept which must be presented to the Universal Mind could be brought into touch at all with human reason only by the employment of the wonderful power of mathematical analysis to its utmost extent. The human reason could form a direct physical concept of no higher stage than the representation of the sequence of changes of a single particle of which the aspect was neglected. The first step beyond this carried us from a space of three dimensions, in which the human reason can form physical concepts, into a space of four dimensions in which we can form no physical concept. The mathematics show that this step is legitimate, and might therefore be represented as a physical concept in an intelligence of a higher order than human. They also show that this step from a space of any number of dimensions to a space whose dimensions are greater by unity is always a legitimate one. Each step, however, would require an advance in the order of the intelligence required to form a physical conception of the corresponding stage of the representation. To represent the complete sequence of changes of a single particle, including its changes of aspect, would require three steps beyond the highest of which the human reason is capable of forming a physical concept, and six more steps would be required for every additional particle in the universe beyond the first. Moreover, the completion of all the steps required for the inclusion of every particle in the universe would carry us over a comparatively small portion only of the total number, for it has been pointed out that a far larger number of steps would be required for the inclusion of all the possible modes of ether vibration. Every such step would require an increase in the

order of the intelligence. Each step would, however, be merely an increase in degree and not a change in character, for no powers would be called for except that of so modifying the distribution of energy in the universe as to attain the end represented in the concept formed in the Universal Mind corresponding to the whole series of steps.

If, therefore, it can be shown that the power, attributed by the consciousness of mankind to the human mind, of modifying its environment by purposive action directed towards the attainment of an aim presented in a general concept, is actually possessed by it, it will follow that the hypothesis of the Universal Mind would be capable of accounting either for the maintenance of the visible inanimate universe without beginning or end, or for its building up from any initial distribution of its energy content, without attributing to the Universal Mind any powers differing in kind from observed powers of the human mind.

Our next step will, therefore, be the further consideration of the observed correspondence of brain changes and changes in consciousness. Now all our experience in the correlation of physical phenomena, as represented in the construction of the first two models, has taught us that the first step towards a complete correlation of two series of phenomena exhibiting such a correspondence must be to regard the two series as isolated from the rest of the complex of which they form a part, and connected by a direct causal relation, whichever of the two series precedes the other being considered as the cause, and the other as the effect. No physicist attempts to justify the assumption of such a direct causal relation. He knows from previous experience that the assumption is justified by its results, in that it is found to be the only method of arriving at a first approximation to the correlation of the two series. As he succeeds in arriving at successive approximations towards the

complete correlation of the two series he finds that at each step in advance he has to take into consideration a larger portion of the whole complex of which the two series form a part. The completion of the process, that is to say the complete correlation, is unattainable to the human mind, for even if we started with a single pair of the simplest and most directly related phenomena, say in the energy model, their complete correlation could be effected only by absolutely completing the construction of the whole model. It is only by following this process of approximation step by step that the physicist has acquired the wider conception of the nature of causality which was referred to in chap. iii (p. 40); that is to say, that the only meaning that can be ascribed to physical causality is that it is the expression of the results of observation that all known physical phenomena are interrelated in a complete ordered whole in such manner that no portion can be abstracted without modifying the whole system in such a way as to be more or less sensible in every portion.

The first approximation to the solution of the complete interaction between mind and its material environment, or, in other words, between mind and its energy environment, if attainable at all, is to be sought in the interaction between an individual human mind and its immediate material environment, the grey matter of the individual brain, both mind and brain being considered as independent units; that is to say, without regard to their respective relations with the Universal Mind and the general material environment. To deny this would be to deny the procedure by which all progress in physical science has been made. Indeed, in view of what physical science has taught as to the real nature of causality, such denial would involve denying that mind and matter are included in an ordered interconnected system. It would be equivalent to asserting that nature is not order but chaos,

and would therefore involve a denial of the possibility of science. The observed correspondence between brain changes and changes in consciousness, therefore definitely establishes the fact that there is interaction between mind and matter; that is to say, between mind and energy. Moreover, it is a fact of observation that the action takes place in both directions, that brain changes give rise to changes in consciousness, and that changes in consciousness give rise to brain changes. That is to say, mind both influences matter and is influenced by it; or, in other words, mind is, as a fact of observation, capable both of effecting changes of energy distribution, and of being affected by, and therefore becoming aware of such changes.

Psychologists who desired to reconcile their psychological experience with the materialistic hypothesis that mind was capable of inclusion in the mechanical scheme, or model, have propounded two alternative hypotheses.

The first of these is, that the observed correspondence between brain changes and changes in consciousness should be regarded as a mere concomitance, involving no causal relation at all. This directly denies the validity of the procedure by which the mechanical model was constructed, and by implication denies the existence of the order which is exemplified in the mechanical model, and to which that model forms a first approximation. As Professor William James observes, it might just as well be maintained that the melody from a musical instrument accompanies, but does not depend upon, the actions of the player.

The second hypothesis admits action by the brain upon the consciousness, but denies any reciprocal action of the consciousness upon the brain. This is a simple denial of the observed facts. Both hypotheses offered noteworthy examples of the attitude of superstition, which distorts or denies facts of expe-

rience when they are in conflict with preconceived hypotheses.[1]

The power of the human mind to influence matter, that is, to influence the distribution of energy, is therefore established by evidence as conclusive as scientific evidence can be. Hence it follows that the hypothesis of the Universal Mind is a perfectly legitimate physical hypothesis, for it has been shown capable of accounting for either of the two alternatives, the origin of the inanimate visible universe in time, or its maintenance as a conservative system without beginning or end, simply by attributing to the Universal Mind an extension of the observed powers of the human mind. We now have to test this hypothesis by attempting to apply it to the elucidation of the further problems of nature of which the energy model has hitherto failed to supply a solution.

The first of these, after the original problem for the solution of which the hypothesis was propounded, is the formation of the electrons in the ether. There is no process known to physicists by which even a single electron could be formed in a perfectly fluid ether, and if the ether were not perfectly fluid the whole visible universe would, in a shorter or longer period, vanish from our ken as a smoke-ring vanishes when it has been formed in the air. Yet an electron is merely a special kind of energy distribution, and as such can be accounted for by the operation of the Universal Mind. The difficulty of accounting for the origin of the electrons by means of unconscious activities only is much enhanced by the fact that, within the limits of our powers of observation, aided as they are by the most delicate physical instruments

[1] The author has dealt with other aspects of the impossibility of the materialistic hypothesis in the *Problem of the Universe*, chap. xxiv, "The Place of Mind in the Universe"; and in *The Superstition called Socialism*, chap. viii, "The Impossibility of Materialistic Determinism."

and by the most profound refinements of mathematical analysis, every negative electron appears to be similar in every respect to every other negative electron, and the same holds good of the positive electrons. This uniformity in the electrons, and in the atoms and molecules built up of electrons, is incomparably more perfect than the utmost perfection of human handicraft can attain to. But the nearest parallel to their uniformity is to be found in products manufactured by instruments of precision constructed and operated under the guidance of human intelligence. That is to say, the electrons bear the impress of articles manufactured under the guidance of intelligence incomparably superior to any human intelligence, and we should be justified in applying to them the words which Clerk-Maxwell, who has been described as "the greatest mind of the nineteenth century", applied to the molecules in his memorable address to the British Association in 1873:

"They continue this day as they were created, perfect in number and measure and weight; and from the ineffaceable characters impressed on them we may learn that those aspirations after accuracy in measurement, truth in statement, and justice in action, which we reckon among our noblest attributes as men, are ours because they are essential constituents of the image of Him who in the beginning created, not only the heavens and the earth, but the materials of which heaven and earth consist."

This further difficulty finds a complete solution in the hypothesis of the Universal Mind.

The next problem for our consideration is the problem of the nature and origin of life. No hypothesis has ever been propounded which offers even a superficially plausible representation of the nature of life in terms of the energy model, much less in terms of the mechanical model, and no experimenter has yet succeeded in discovering a beginning of life.

Professor Tyndall's celebrated statement in 1878 is as indisputable now as then. He wrote: "I affirm that no trustworthy shred of experimental testimony exists to prove that life in our day has ever appeared independently of antecedent life."[1]

Nevertheless, our present point of view does not in any way even suggest the improbability of the discovery of the conditions under which the inception of life occurs, and such a discovery would in no way affect the argument here presented. All physiological research leads to the conclusion that living matter is subject to all the known mechanical and molecular laws of non-living matter. The only observed distinction between the two is the invariable association of purposive action with living matter, even in so lowly an organism as the moneron. Haeckel, who has made the most exhaustive researches into the life history of the many forms of monera, tells us that in its simplest form the moneron is a mere globular mass of slime, consisting of a single cell without nucleus or integument. Yet, not only is it capable of extending portions of its substance into tentacle-like protuberances employed in securing the tiny organisms upon which it feeds, but these tentacles reject unsuitable particles such as grains of dust or flint, while food particles are enveloped by them and drawn into the substance of the creature. The food is digested by the simple process of solution in the mass of slime of which the creature consists. Similar purposiveness is found to be associated with all plant as well as all animal life, but it is only the higher forms, possessing some trace of nervous organization, which biologists regard as in any sense conscious.[2]

Some biologists have suggested that something

[1] *Nineteenth Century*, 1878, p. 507.

[2] Some very striking analogies between non-living and living matter are discussed in *The Problem of the Universe*, pp. 434 et seqq., where also some noteworthy examples of purposive action in plants are considered, mainly from Darwin's writings.

which I may call mind-stuff, to use a term of Professor Clifford's, is developed in the brain cells of men and animals, and Haeckel assumes that it is developed in every living cell. To assume, however, that purposiveness arises in some manner from a supposed increasing complexity of molecular structure would not in any way assist us in the further correlation of phenomena unless purposiveness could be expressed in terms of energy, and no suggestion has ever been made which would so much as make such expression conceivable. Even putting this aside, the appearance of purposiveness in association with the drop of slime known as a moneron would be entirely unaccounted for by any hypothesis of the development of mind as the result of organization. Haeckel realized this difficulty, and attempted to surmount it by assuming the presence of mind in every atom, thereby plunging into the absurdities which were referred to in chap. i. What he entirely failed to realize was that, even if he could have avoided these absurdities, this procedure would not have solved the problem, but merely evaded it by relegating mind to the unknown constitution of the atom. The acceptance of the representation of the constitution of the atom as presented by modern physics, and embodied in the energy model, would leave him no alternative but to continue the process of evasion by relegating mind to the unknown in the shape of the electronic nuclei. This, however, would not bring mind within the scope of the energy model. Haeckel's procedure was not merely an evasion, but an illegitimate evasion, of the problem, since it involved the negation of the observed laws of dynamics. Nevertheless, it will be worth while to follow his procedure to its legitimate conclusion by introducing the modifications absolutely necessary in Haeckel's hypothesis in order to bring it into accordance with the observed facts. In the first place, it is requisite, in order to bring the hypothesis into agree-

ment with Newton's three laws of motion, which summarize the observational foundations of dynamics, that the mind attributed to each atom, and necessarily also to each electron, should, although capable of influencing its own motion, remain completely inactive under all circumstances except when it forms a portion of some living substance. This, in itself, would involve a high power of self-restraint, and a correspondingly high intelligence. Far more than this is, however, requisite, for dissipation of energy is the observed state of that portion of the universe in which it is possible for us to determine the energy conditions; that is to say, the representative point of that portion is at present moving on a down-grade path. If the universe be a conservative system with neither beginning nor end, then the intelligence of the electrons and atoms would have to be of a sufficiently high order for a level path to be maintained by their co-operation throughout the visible universe. On the other hand, if the universe has originated in time, then an upward-grade path must have been maintained during some past period by a similar co-operation. Either process would require an intelligence on the part of each electron or atom of an order comparable with that of the Universal Mind, an utterly absurd conclusion. The conclusion of physical science is, however, that the electrons and atoms are all interconnected through the ether to form a unity, and therefore it would be more natural to suppose the intelligence also to form a unity, instead of existing in the form of separate units in the individual electrons. This eliminates the absurdity of electrons with God-like minds by including them all within the sphere of action of the one Universal Mind.

Since the only difference that can be detected between non-living and living matter consists in the absence and the presence, respectively, of mind in association with it, and since the presence of

mind in living matter cannot conceivably be accounted for by any development of the mind from the matter, we are driven to the conclusion that life originates by the association of pre-existing mind becoming associated with non-living matter, and thereby transforming it into living matter; that is to say, by the influx of the Universal Mind into matter, and its permanent association therewith. The Universal Mind is therefore to be regarded as the author and giver of life. We may arrive at the same conclusion by another method. Since the only difference that can be detected between living and non-living matter consists in the presence of mind in the former and not in the latter, it will follow that the power possessed by every kind of living organism, and by living organisms only, of reproducing its kind, that is to say of conferring life similar to its own upon non-living matter, must be due to the mind expressing itself through the organism. Now, by our original hypothesis, the Universal Mind possesses, to a greatly enhanced degree, all the powers possessed by the minds of all living creatures. The Universal Mind must therefore possess the power of conferring life upon inanimate matter. The conclusion that it is from mind that an organism derives the power of reproducing its kind receives striking confirmation in the well-known deleterious effects of fright and other mental disturbances upon breeding mothers, both in mankind and in the higher animals.

We see, then, that the nature of life is fully accounted for as an association of mind and matter such that the action of the former on the latter is not simply an external action, but takes place in and through the latter, and that in this manner every organism acquires a certain unity of its own, without thereby becoming separated from the whole. Further, the only origin of this association which can be reconciled with observed facts that is to say, the

only possible origin of life, is by the change in the interaction between existing mind and existing matter which I have expressed as the influx of mind into matter. We can now justify the assumption made in my definition of mind, that purposiveness has the same essential basis whether consciously directed by the organism or not; for the observations of biologists upon organisms of all grades indicate very plainly that there is a gradual ascent from the most rudimentary form of sensation, accompanying the first advent of life, to the full consciousness of an *ego*, or *self*, knowing its own existence; and that this *self*, even in its most rudimentary form, appears first in man, and in its fully developed form, only in man after he has attained a high grade of development.

We are now in a position to prove that the existence of a Universal Mind, which has hitherto been treated as a working hypothesis only, is a necessary consequence of firmly established scientific conclusions, and the proof may be very simply formulated.

Every known living organism consists of mind (in the sense defined on p. 116) associated with matter.

The matter of such organisms forms, together with the inanimate matter of the visible universe, an interrelated whole expressible in terms of energy only.

The minds of these organisms must either be discrete centres of activity embedded in this unity of energy, or form, together with it, an interrelated whole.

The former alternative is disproved by the proved interaction between the mind and the matter of each organism, since all matter in the visible universe is included within the unity of energy.

The minds of all known organisms must therefore be included in an interrelated whole of mind and energy, and there exists, therefore, a Universal Mind constituted by the interrelated minds of all known living organisms. This demonstration, on the basis

of established physical data, of the actual existence of a Universal Mind, although of insufficiently extended content to account for the building up or maintenance of the universe, affords an absolutely incontrovertible proof of the physical legitimacy of the larger concept, which may henceforth be regarded as an established portion of physical theory.

It is obvious that a Universal Mind restricted in content to the minds of known terrestrial organisms, including, of course, human minds, would be altogether inadequate to the formation of the whole visible universe from pre-existing conditions, or to its maintenance as a conservative system without beginning or end. If, however, the content were extended to include all minds existing within the visible universe it is quite conceivable that the powers of a Universal Mind so constituted might be adequate for the purpose.

The whole course of the ascent of organisms in the scale of life, from its earliest dawn to the appearance of man, is found to be most wonderfully illuminated when viewed in the light of the pre-existence of Universal Mind[1], which removes the greater difficulties of the theory of organic evolution as developed by Charles Darwin and his successors. Universal Mind appears as a guiding activity throughout the whole process, gradually building up material organizations of ever-increasing complexity suitable for the reception of its ever-increasing influx. This ever-increasing influx, moreover, accounts in the most complete and satisfactory manner, not only for the development of man as the highest form of animal life, but for the advent of human reason, and of the spiritual faculties and aspirations which distinguish man from the brute creation. This is fully dealt with in chap. v,

[1] See *The Problem of the Universe*, pp. 483 et seqq. Also *Modern Biology and the Theory of Evolution*, and *The Berlin Discussion of the Problem of Evolution*, by E. Wasmann.

in which I have endeavoured to show that, by means of these higher faculties, we may transcend the procedure of physical science, and pass from the consideration of the successive models constructed by the application of its methods, to a vantage-point from which a real though restricted insight is obtainable into the nature of the reality of which these models are but feeble and inadequate representations. A far higher vantage-point for this view would doubtless be attainable could we only develop the construction of the mind-model to the extent to which the energy model has been developed. For if we could accomplish this we should attain, by a continuation of the purely physical procedure, an adequate representation of all the phenomena of mind and energy, as observed in the visible universe, in terms of mind. We should thus attain, by purely physical methods, to a resolution of the apparent duality of mind and energy as complete as the resolution already effected of the apparent dualities of matter and ether, and of ether and energy.

The data requisite for this are not at present available, but their accumulation has already begun. That comparatively new field of scientific research, experimental psychology, has already made significant progress in the resolution, or rather the transformation, of the interrelated complex of mental phenomena into groups, each consisting of similar elements, and the process of obtaining first approximations to the correlation of different groups has also begun, and this process, similar in every respect to that employed in the building of the mechanical and energy models, is the process by which the construction of the mind-model proceeds.

At the present stage of development of the mind-model we are entitled to draw from it the conclusion that the visible universe of life and matter has as its essential basis a directive and constructive intelligence

capable of building it up from any initial distribution of its present energy content, and of maintaining its existence indefinitely or for any period which the intelligence itself may determine. If the mind-model could be sufficiently developed to afford an adequate representation of energy and all its phenomena expressed in terms of mind, we should be entitled to draw the further conclusion that the intelligence was capable of calling the energy itself into existence, and conversely, of annihilating it at will, and that the intelligence was, therefore, not merely directive and constructive, but also creative. It would therefore lead directly to the concept of a creative God of sufficient power to call the universe into existence, and to maintain it, but not necessarily of infinite power. As I have expressed it elsewhere [1]:

"The very limitations inherent in the nature of this argument constitute much of its value. In place of a direct presentation of the self-existent, self-determined, and therefore infinite, ultimate reality, which our reason is, in consequence of its own limitations, totally incapable of comprehending, it leads to a presentation, limited indeed, but only to the extent of our own powers of comprehension. We have presented to our cognition those aspects only of the ultimate reality which are in direct relation with ourselves, and to the extent only to which our limited reason is capable of cognizing them."

This is all that can possibly be accomplished by the procedure of physical science, for its method is to approximate to reality by the construction of successive models. In passing from the consideration of the system of models to that of the reality itself, we pass from the domain of scientific to that of philosophic thought.

[1] *Problem of the Universe*, p. 498.

CHAPTER V

PASSAGE FROM THE PHYSICAL MODELS TO GOD AS THE ULTIMATE REALITY

SUMMARY

The Deistic conceptions of God as the *Unknowable*, and as the *Ens Realissimum* of Kant, are based upon a misconception of the nature of causality.

Resolution of the Dualism between mind and matter, and the complete Rationalization of the Universe in terms of the Eternal Self-Consciousness, God Immanent and Transcendent.

Deism, Pantheism, and Theism. The assertion of Deism involves a denial of all possibility of knowledge.

Professor Royce's conception of God as Omniscience is shown to be essentially true in that it cannot be denied without self-contradiction.

The six stages in the Development of Consciousness; and Dr. Laurie's argument, from an Analysis of Percipience, showing that the Ultimate Reality of Being is Universal Mind.

Will is shown to be an aspect of God, the Absolute, and, as expressed in Love, to form the essential ground of Individuation.

God, the Absolute, is necessarily a Multiplicity in Unity.

Summary of the proofs of God's existence, of Freedom, and of Personal Immortality.

This Freedom does not involve indeterminism in the Absolute.

The inevitable presence of Evil during the progress of the creative evolution of a world containing free individuals.

Harmony is the complete good for each as well as for the All, and the pursuit of harmony as an end is the ideal of duty, a concept which could have no meaning in an anarchic world.

The question of the possibility of persistence of Animal Souls.

In chap. iv the existence of a Universal Mind has been established upon a purely observational basis, and its intelligence and power have been shown to be so great as to transcend any possible effort to grasp them, or even to form any representation of them except in terms of mathematical concepts. The whole visible universe of life and matter has, moreover, been shown to be capable of expression in terms of this

Universal Mind, and of energy controlled by it. It is thereby definitely demonstrated that both Atheism and the more subtle Agnosticism are absolutely incompatible with an acceptance of the established conclusions of physical science. The concept of the Universal Mind, moreover, provides a far more adequate concept of a creative God than could possibly be formed by any untrained mind, representing as it does a power capable of evolving the visible universe from an initial state in which there would be nothing perceptible to the human senses. In order to effect the passage from this representation of God to God Himself, as conceived by the philosophic theologian, to the Ultimate Reality of the philosopher, two steps are still requisite: the duality between Universal Mind and energy must be resolved into unity, and this unity must be shown to be self-existent and self-determined, and therefore infinite. It is pointed out in chap. iv that the first of these steps might quite conceivably be made by a continuation of the purely physical process of construction, but that this is not feasible at present, since the necessary data are not available. The second step is entirely beyond the reach of any physical procedure, for all such procedure is essentially finite, and to attempt to reach the infinite by its aid alone would be as hopeless as to attempt to extend our vision beyond space by means of a telescope or a microscope.

When I first arrived at the provisional representation of God as mind-directed energy, in other words, intelligent power, the further passage to the complete unification of all experience in terms of one self-determining, and therefore infinite, self-existing reality appeared to be barred by Kant's argument in *The Critique of Pure Reason*, according to which it is impossible either to prove or disprove the existence of a *Supreme Being*. A restudy of the *Antinomies of Pure Reason*, which led up to this argument, con-

vinced me that their principal difficulties disappeared in the light which the advance of scientific knowledge has thrown upon the system of nature. We have learned, in the first place, that the direct causal relation assumed to exist between two phenomena, or series of phenomena, is merely a first approximation, and leads, not to the linking up of phenomena into a series of indefinite extent, in which each term is the effect of the preceding term and the cause of the succeeding one, but to the conclusion that the cause of every phenomenon is the *All*. We have learned, secondly, that the real universe is a unity and not an aggregate of elements, as represented in the physical models constructed by reason; and thirdly, that the apparent uniformity of nature is not the uniformity of a mechanism, but merely a statistical uniformity which leaves room for a very considerable freedom of action arising from the self-determined initiative of such activities as the wills of human beings.

The search for *a Supreme Being*, designated by Kant as *Ens Realissimum*, proceeds by way of the now abandoned assumption of a chain of causality, leading, as Kant expresses it, to an indefinite regress along such a chain. Each successive step reveals a cause more fundamental than the preceding one, but since the totality of the universe can never be brought into the sphere of our experience, the last step or steps must necessarily pass beyond sense experience, and therefore the *Ens Realissimum* can only be a concept, of the reality of which we can have no assurance. Kant defines the *Ens Realissimum* as something that exists necessarily. But since all knowledge is derived from experience, the *Ens Realissimum*, if outside the sphere of experience, can have no content of knowledge, and must remain for us a mere empty abstraction, such as self-identity, from which all the relations derived from experience have been eliminated. There would be no meaning either in affirming or denying

it. It would be the pure Being, empty of all content, which Hegel identifies with Non-Being. The unity towards which we have been approaching through modern physical science is, on the other hand, one which shall include all experience within it. I then turned to Hegel for assistance. I had attempted to read him in my undergraduate days, but finding him absolutely incomprehensible, I abandoned the attempt in despair. Now, however, under the illumination thrown on his procedure by the knowledge of the real nature of causality as revealed by physical science, it was comparatively easy to follow the argument of *The Logic* where, in an exhaustive analysis of mind, he shows that the relation existing between the categories of the understanding is of exactly the same character as the law of causality now known to hold good in the material universe of physical science. The several categories are considered, for a first approximation, as separate entities with direct relations between them. He then shows that, although this stage cannot be dispensed with, it leads inevitably to contradictory results, which can be eliminated, or rather resolved into higher verities, only when it is realized that the different categories are not isolated ideas and mere instruments of thought, but are elements in a complex whole or stages in a complex process, and that the mind in its unity is itself this complex whole or complex process. The categories are shown, in fact, to form a complex of essentially related transitory existences, each of which exists only as determining, and being determined by, the remainder in accordance with universal laws. The categories are, therefore, ultimately left to define themselves simply by the necessary movement of thought through which they carry the mind, and it is then found that they lead to the idea of self-consciousness as their ultimate meaning or truth. The intelligence then realizes itself in the phenomenal

world by discovering that it lies in a world of objects, each and all of which exist only in so far as they exist for intelligence, and in so far as intelligence is revealed or realized in them.

Hegel attempted, in the *Philosophy of Nature*, to prove that the laws of the phenomenal world are, in their essential character, identical with the laws of the intellect, in which case Nature as well as Intelligence would find its ultimate expression in terms of self-consciousness. The development of physical science had not then reached a sufficiently advanced stage to enable this to be effected with any approach to completeness, but the development of the energy model as set forth in chap. iii, and the relation between mind and energy established in chap. iv, has made it possible to carry Hegel's argument to the final stage of complete demonstration, and shows that if mind is not itself the unity within which energy is embraced and from which it proceeds, both must necessarily be included in a higher unity including mind in all its fullness.

The physical argument, so completed, therefore leads to a complete resolution of the Cartesian and Kantian dualism between mind and matter, between the percipient subject and the perceived object. It therefore effects a complete rationalization of the whole scheme of the universe as known to us. Reason, the highest principle of mind as we know it, is shown to reign supreme throughout the universe, subject only to the possible existence of higher principles representing aspects of the ultimate reality which are beyond the reach either of our powers of observation or of our reason.

The whole universe of mind and matter, now shown to be completely expressible in terms of mind, may be compared to a living organism, the central principle of which is self-determining Being. The independence of the constituents of this organism must not be such

as to permit of any such break in their connexion with each other as would destroy the unity of the whole. The universe then appears under one aspect as a unity in which there is no place left for difference or distinction, while under another aspect it appears to be separable into an indefinite number of self-centred, or self-determined, individuals. This is Hegel's conception of the universe, and as E. Caird points out[1], it is through the specific determinations of these individual portions that they form one whole, and though a self-determining principle is present in these determinations, and gives the individuals a certain independence, "yet they in turn are limited in themselves, and only maintain themselves as the principle realizes itself in them, or, in other words, as they in turn surrender themselves to the life of the whole. Their capacity of so surrendering themselves, in short, is the measure of their reality. Thus the unity as a self-determining principle is in the differences, but it is also in their negation, by which they pass beyond themselves as individuals and so return into unity."

It has been pointed out in chap. iv that the *Deistic* conception of God is the one to which we should be driven if we could discover no traces of the presence of God within the universe. We have seen that science negatives this conception, which was founded upon a misconception of the nature of causality. Being placed entirely outside experience, this conception of God could have no content derived from experience, and could therefore be described only by negations. Such a God, which is represented by the *Ens Realissimum* of Kant and the *Unknowable* of Herbert Spencer, could be of no practical interest to man, and the affirmation of His existence would mean nothing more than the admission that our

[1] *Hegel*, p. 180.

knowledge is essentially limited, that beyond the known there must always be the unknown.

The *Pantheistic* conception, which identifies God with the knowable universe, would fulfil the demands of science, the procedure of which is essentially limited to the finite. It would not, however, satisfy the demands of reason for a complete self-determined, and therefore infinite unity, for its content is limited to our actual and conceivable experience.

The *Theistic* conception, to which the path of science has led us, has for its content the whole of actual and conceivable experience, but is not limited to this content. It presents God as not only immanent in the universe but as also transcendent, as truly knowable and yet incomprehensible, for this conception admits an unknowable as well as a knowable content. It is a conception of a truly living personal God, "in whom we live and move and have our being", and from whom our limited personality derives its origin, a God of whom we may say that the visible material universe is but His vesture. The *Theistic* conception includes, moreover, not only all scientific experience, but all the mental and spiritual experience of man. It is in full accord with the experience to which the greatest sages and seers of all ages bear the most strikingly concordant testimony, the possibility of a temporary realization in consciousness of the unity of the finite human personality with the infinite personality of which it is a finitization. I have shown elsewhere[1] how the ancient sages of India, starting from this experience, evolved a theory of the universe which, in its general outlines, is in startlingly close agreement with the scientific presentation of to-day. Finally, the experience which forms the known content of the *Theistic* conception includes all that is to be learned from the life and teaching of Jesus Christ Himself.

[1] *Problem of the Universe*, pp. 503 et seqq.

The relegation of God as the Ultimate Reality to the unknowable region lying outside all experience involves, as a necessary logical consequence, an absolute philosophical Nihilism consisting in the negation of the possibility of all knowledge. Kant endeavoured to escape from this by the introduction, as a regulative principle, of what he calls *the Practical Reason*, based on the categorical imperative of conscience, the sense of "ought", of duty, which is a universal experience of the human mind. This, however, necessarily established an absolutely irreconcilable dualism between the intelligence and the phenomenal world, as became abundantly evident through the subsequent development of the two aspects of Kant's system by Fichte and Schelling respectively. The origin of this discord is easily seen from our present standpoint.

In Kant's day the mechanical world-model was regarded as a complete representation of the material universe, and therefore Kant could discover no evidence of the action of a Deity within this universe. He found it in the mental experience of the imperative of conscience. This experience was not, however, derived from sensation, and in the *Transcendental Analytic* he had defined reality as given in and through sensation. It was this restricted definition of reality which prevented him from accepting the direct experience of consciousness as bringing the Ultimate Reality, or God, into the sphere of experience. The *speculative reason*, on the basis of a mistaken view of causality, placed God entirely outside the sphere of experience, while the *practical reason* placed Him within this sphere. The two conceptions are therefore inconsistent with each other, and if the validity of the argument developed in these pages be admitted, the former one must be rejected. This involves also the rejection of the *Critical Idealism* of Kant, now usually designated *Realism*, according to which the *phenomena* which constitute our experience are caused by actually existing

objects which transcend all experience, and of the nature of which we can therefore know nothing. These assumed transcendent objects Kant calls *noumena*, or things in themselves, and the establishment of their reality would involve an indefinite regress along a chain of causality, as in the case of the *Ens Realissimum*.

All experience comes to us in the form of presentations in our consciousness, but an element universally present in that consciousness is the feeling of a *beyond*, of something independent of the conscious self or subject. It is this feeling which causes the ordinary man to reject with ridicule the *personal idealism* of Berkeley. The ordinary man, if the suggestion be presented to him that, for all he can know, he may be the All, and the whole external world a mere figment of his imagination, *feels* that the suggestion is absurd. The thinker, who is not content to rest satisfied with this mere feeling as ground for the rejection of *personal idealism*, finds his feeling corroborated by the experience that he is unable to construct his world just as he pleases, together with his experience of the sameness of the objects of the various experiences and thoughts which present themselves to his consciousness as the experiences and thoughts of minds similarly constituted to his own. This sameness is essential to all rationality, for in its absence science, that is to say organized knowledge, would be impossible. The question of what is the meaning of this reference to a *beyond* in all experience has, however, as Professor Royce has pointed out[1], two alternative answers. One is the answer which we have found ourselves compelled to reject, that the reference is to a reality which exists independently, not only of the experience in question, but of all possible experience. There remains the alternative that the reference is to other possible experience not here presented. Possibilities

[1] *The Conception of God*, p. 149.

of experience, in so far as they remain bare possibilities are, as Professor Royce observes (p. 163), "as unintelligible as the realists' things in themselves"; but the genuine possibilities of experience, e.g. of the past, of the future, or as presented through the minds of others, do actually present themselves as references to a *reality*. The thesis is, as stated by Professor Royce (p. 165), "that our experience, as essentially imperfect, that is, as not fulfilling the very ideas which we ourselves have acquired in presence of this experience, demands from us statements as to whether these ideas are truly fulfilled or not. For instance, we have an idea of the whole world as a whole. No matter how we came by the idea, the question inevitably arises: "is there any whole world of fact at all, or is this fragment of experience before us all the fact that there is?" . . . "Either a true or a false answer to our questions, if now given, would be true or false by virtue of its agreement with contents that, if presented, would confirm or refute the supposed answer." . . . "All such questions, whether just now a definite answer for any one of them is true or false, or whether any one of them is a meaningless question, imply beyond our own experience a 'present possibility of experience' such as even now warrants the truth of some assertion in reply to each question. It is in this sense that our experience implies a beyond, and a beyond that, in the first place, appears as a world of definite 'possible experience' having a determinate, and in the end inevitably, a true total constitution." . . . "The inevitable result is that the total constitution of the world of fact must be presented to a concrete whole of actual experience, of which ours is a fragment. The intimacy of the relation of our fragmentary experience to this total experience is indicated by the way in which our experience implies that total." This leads necessarily to the conception of the *beyond* as being "the Concrete Whole of an

Absolute Experience, wherein the thoughts of all the possibilities of experience get their right interpretation, their just confirmation, or their refutation,—in a word, their fulfilment."

It will be seen that Professor Royce's conception of God as the absolutely complete experience is essentially identical with the conception which we have reached by following the physical path as far as it could be followed, and then completing the conception by means of a philosophical argument depending upon the observed identity in the essential characters of the material universe and the universe of intelligence. Professor Royce starts his inquiry by a preliminary definition of the word "God" in terms of Omniscience, stating that by this term he means, "in advance of any proof of God's existence, a being who is conceived as possessing to the full all logically possible knowledge, insight, wisdom." The only point in which I should like to amend this definition would be by substituting the words, "Being which is conceived" for "a being who is conceived", in order to make it perfectly clear from the start that the aim of the inquiry is not a being amongst other possible beings, but Being itself, which altogether excludes the possibility of "other than itself." This point, however, becomes abundantly clear in the development of Professor Royce's argument.

The problem then becomes this: "Does there demonstrably exist an Omniscient Being? or is the conception of an Omniscient Being, for all that we can say, a bare ideal of the human mind?" "An Omniscient Being", he explains, "would be one who simply found presented to him, not by virtue of fragmentary and gradually completed processes of inquiry, but by virtue of an all-embracing, direct, and transparent insight into his own truth,—who found thus presented to him, I say, the complete, the fulfilled answer to every rational question" (p. 8). The

answer to this problem is that such Being does demonstrably exist, that experience does constitute in its entirety, one self-determined and consequently absolute and organized whole. For the denial of this would involve the assertion that the whole world of experience is a world of fragmentary and finite experience, which is easily seen to involve a contradiction. Professor Royce demonstrates this in the following argument (p. 41) :—

"All concrete or genuine, and not barely possible truth, is, as such, a truth somewhere experienced. This is the inevitable result of the view with which we started when we said that without experience there is no knowledge. For truth *is*, so far as it is *known*. Now, this proposition applies as well to the totality of the world of finite experience as it does to the parts of that world. There must, then, be an experience to which is present the constitution (i.e. the actual limitation and narrowness) of all finite experience, just as surely as there is such a constitution. That there is nothing at all beyond this limited constitution must, as a fact, be present to this final experience. But this fact that the world of finite experience has no experience beyond it would not be present, as a fact, to any but an absolute experience which knew all that is or that genuinely can be known; and the proposition that a totality of finite experience could exist without there being any absolute experience, thus proves to be simply self-contradictory."

Professor Royce's answer to the ordinary agnostic argument that our experience of the physiology of the senses demonstrates our total ignorance of everything except our sensations, is so illuminative as well as crushing that I must give it in his own words, and at the same time strongly advise the reader to study the book itself, *The Conception of God*, which, in addition to Professor Royce's essay, contains discussions on it by Professors T. Le Conte, G. H. Howeson,

and S. E. Mezes, with a supplementary essay by Professor Royce in reply. The answer to the agnostic argument is as follows (p. 21):—

"The physiology of the senses, then, rightly viewed, does not assert that *all* our human experience is vainly subjective, including the very type of experience upon which the sciences themselves are founded. What science says is simply that there is a sort of indirect and organized experience which reveals more of phenomenal truth than can ever be revealed to our direct sensory states as these pass by. But our popular doctrine of the Unknowable Reality uses this so-called 'verdict of science' only by confounding it with a totally different assertion. The 'verdict of science' is that organized experience indicates much phenomenal truth that the senses can never directly catch. The doctrine of the Unknowable Reality asserts that no human experience can attain any genuine truth, and then appeals to that aforesaid 'verdict' to prove this result. But the sciences judge the ignorance of sense by comparing it with a knowledge conceived to be actually attained; namely, the knowledge of certain indirectly known physical phenomena as they really are, not to be sure as absolute realities, but as the objects of our organized physical experience. You surely cannot use the proposition that organized experience is wiser than passing experience, to prove that no experience can give us any true wisdom."

Both Professor Royce's argument and the argument developed in these pages show that the concept of the Universal Mind, as presented in the latter, provides a representation of the Ultimate Reality, of Being Universal, which is as complete as is possible in the present state of our knowledge, and which is capable of indefinite extension by the inclusion in it of the human experience which may be added to our present store by the scientific research of the future. It provides not only for all existing human experience,

but for all conceivable human experience. The two arguments are founded upon the same basis, the assumption that experience is the sole source of human knowledge, but they follow independent lines of thought, and both of them show that a *complete idealism* leads to the establishment of what Dr. S. S. Laurie calls a *natural realism*. The external world appears as a reality, really presented to the finite consciousness of man, and not constructed by that consciousness. Yet it does not appear as an independent reality, but as a *construct* of the complete, eternal, consciousness. The external world appears as the thought of God, who alone is the Ultimate Reality. The existence of evil may appear to some readers to preclude the acceptance of this conception, but I hope to succeed in showing that the light thrown by the physical argument upon the significance of evil in the time process of creative evolution leads to a resolution of this apparently insuperable difficulty and to the conclusion that the world process, as presented to human experience, is to be considered as truly the expression of the Will of God in the process of becoming.

In order to deal with this problem we must first consider the nature of human will, and thence arrive at a conception of the meaning of Absolute Will or the Will of God. The clearest and most instructive course will be, in my opinion, to follow a third argument, chronologically prior to the other two, by which Dr. Laurie has shown that an analysis of the nature of percipience leads to the conclusion that Being Universal finds its complete representation in terms of Universal Mind. It is developed in a little volume entitled *Metaphysica Nova et Vetusta*, the study of which I would strongly urge upon the reader in conjunction with that of the volume previously referred to, *The Conception of God*.

Consciousness cannot be defined positively except by an equivalent term, such as *awareness*. Laurie

employs the term feeling as the equivalent of consciousness in its most general sense, but feeling must then be employed in its more restricted sense, and not in the more extended one which would make it applicable to the sensitiveness of a moneron to the want of food, or the sensitiveness of a plant to the want of water. Either want gives rise to purposive action; the moneron extends tentacle-like pseudopodia from its substance to search for food and the plant sends its roots in the direction of any moisture present in the soil in its neighbourhood. Yet no biologist would regard these actions as either directed or accompanied by awareness of the want. On the other hand, probably no biologist would deny the existence of such awareness when a snail draws in its horns in consequence of their coming into contact with an obstacle in its path. Still less would he deny consciousness to a frog which, confined under the surface of a vessel of water by an inverted tumbler which does not rest on the bottom of the vessel, seeks for air to breathe, first by vainly attempting to rise through the glass bottom, and then, when it finds this to be impossible, makes its way downwards and escapes under the rim of the tumbler. Consciousness is admitted in the cases of the snail and the frog, and is denied in the cases of the moneron and the plant simply because the two former organisms possess a nervous organization of the character which other experience shows to be requisite for consciousness, while in the two latter organisms no such organization can be detected.

This experience has been gained primarily by the observation under conditions of health, of disease, and of accidental injury, of human beings, who are able to state whether the external impulses observed to give rise to certain actions are or are not accompanied by consciousness; and secondarily by further observations upon animals in which injuries to certain nerve-

centres have been intentionally produced. Such actions in obedience to external impulse are termed reflex actions when unaccompanied by consciousness. Most of the internal organs of the human body function unconsciously under normal conditions. Nevertheless, they are shown to be subject to the control of the mind by the observed fact that they can be largely controlled by means of hypnotic suggestion, which confirms the legitimacy of the extension in chap. iv, of the term mind to a larger sphere than that of consciousness. Moreover, many of these internal functions can be brought under conscious control by persistent training and effort, as is exemplified in startling, and often repulsive, forms by the feats of Indian fakirs. Conversely, actions which are continually repeated under conscious control in response to external impulses tend to pass more and more from the domain of conscious control to that of reflex action. This is shown in the natural habit of breathing and in the acquired habits which play so large a part in manual skill in all kinds of operations. The skill of the rider of horse or bicycle, or that of the sailor or of the motor-car driver, afford familiar examples. Professor William James points out [1], as one of the arguments against the hypothesis of automatism, or mere concomitance of the changes in brain and in consciousness, which was shown in chap. iv to be untenable, the experimental evidence that there is the greatest instability and the least objective determinability of action in the highest conscious nerve-centres, coupled with the fact that this observed distribution is exactly that which is required to make the directive action of consciousness most effective.

The continuous development of mind may be regarded as taking place in six stages, each of which possesses distinct features of its own, although the

[1] *Principles of Psychology*, chap. v.

passage from each stage to the next is a gradual one, without any defined line of demarcation. The first three stages are recognized by the aid of experimental evidence of the character which I have outlined, in combination with the results of observation of the nervous organization of organisms of all grades. The remaining stages, covering the development of the human mind, require for their investigation a combination of the subjective study of the self with the objective study of the mental experiences of other human minds.

1. Reflex Action, in which reaction to external impulses takes place without any accompaniment of consciousness on the part of the organism.

2. Sensitiveness, in which there is a vague feeling of a unit of sensation, but the external impulse cannot strictly be regarded as forming an object to the organism as subject.

3. Sense-Attuition, as Laurie calls it, in which the consciousness, acting like a mirror, receives and reflects a complex of units as a single object to the organism as subject. Laurie points out that the primary experience of the conscious subject is threefold: "the feeling of an impression; the feeling of that impression as not itself, but separate from itself; outside there, i. e. as object; and the feeling of that object as being or actual. The feeling of Being is universal, and it is immediate; by which last term I mean that it belongs to the merely conscious or attuitional subject as such, and is not mediated by any act of Reason; but is wholly prior to the emergence of Reason" (p. 18). The human infant is in the purely attuent state, which is the highest state attained by any animal. The attuent subject is nothing more than a receptive and reacting basis of impressions. Laurie claims (p. 12) that "it is a wholly illegitimate conclusion that sense is not a true reflection of that which is sensed"; that the subject does not con-

stitute the object, but that "the object is constituted for the subject in and through feeling". We have already seen the necessary validity of this claim, the denial of which has been shown to involve the complete negation of the possibility of knowledge. We have seen, however, that the reflection is a true one only in the sense that a reflection in an ordinary mirror is a true one, in spite of the imperfections of the mirror.

Mere sense attuition is immediate, and therefore not yet rational. The attuitional consciousness of animals does frequently make inferences, but they are immediate inferences from the particular to the particular. Laurie observes that inference of this kind may be regarded as the germ or anticipation of reason, just as reflex nerve action is an anticipation of rudimentary consciousness. The attuent, or animal, consciousness has not only the feeling of *outside there*, that is to say, of space; but also the feeling of *then* and *now*, that is to say, of time, for animals and human infants prior to the emergence of reason have both memory and expectation. Moreover, we learn, partly by observation of the higher animals, and far more by observation of the psychology of the child, that the feeling of Being in objects of the attuent consciousness is extended so as vaguely to include the self as one of these objects. We thus have an anticipation, a germ of the rational self-consciousness in which the self definitely becomes an object to self in such manner that the thinker becomes conscious of the object as subject, and of the subject as object, and the *Is* of the child becomes the *I am* of the thinker. The germ of this state continues its development throughout the fourth stage which we now have to consider, and its full development into *Personality* constitutes the fifth stage.

4. Percipient or Rational Consciousness. In Sense-attuition the subject is passive, being merely

receptive, so that the subject is the slave of the object. In Percipience, as Laurie employs the term, the subject dominates the object, for percipience is the result of the first stage of the active Reason-Process. Percipience or perception is therefore knowledge, and it is attained, not immediately, but through the mediation of a process. The introspective study of the mind teaches us that the initiation of the reason-process consists in the emergence, within the mind of the conscious subject, of a spontaneous activity, which is called the Will. The Will, with the purpose of attaining knowledge, initiates a movement from within the mind of the conscious subject. It arrests, by an act of attention, the flux of impressions upon the attuent consciousness, and so maintains the presentation in consciousness of certain details which it separates out, proceeding by way of the law of excluded middle, A is either A or not-A; the law of contradiction, A is not not-A; and the law of sufficient reason, *therefore*; to the affirmation of identity, A is A; and so effects the primary synthesis of subject and object. The purpose or end of the movement is knowledge, the attainment of a percept, but, as Laurie observes, "the particular end is not, and cannot be, in the movement as such in its initiation; otherwise it would begin where it ended, which, besides being contrary to phenomenological fact, is absurd. On this primary fact then, of pure intelligence, not of moral or pathological motive, I rest Will as free and autonomous" (p. 38). Will is therefore essentially spontaneous, so that the expression Free Will is really tautological. It is in the emergence of this spontaneous activity that mind proclaims itself reason. At the moment in which perception is completed as affirmation, an inevitable impulse arises to externalize the fact of percipience by a vocal or other sign, and so language comes into being, the product of reason and its potent instrument, the external mark and seal which dis-

tinguishes man from the brute. As Laurie writes (p. 45):—"It is this act of Will which transforms the animal attuitional intelligence into human percipient intelligence, which proclaims that the boundary of the non-rational has been overstepped, and that the subject has become, once for all, rational. Will is thus seen to be, in its initiation, the root, and in its form, the essence, of Reason; and Willing in its primal act is ground and possibility of Knowing."

The restless will, in the ever increasing strength of its own spontaneity, as self-realization develops through the exercise of its activity, does not remain satisfied with this primary synthesis, but pushes forward to new conquests. It attacks the various totalities presented to the attuitional consciousness, analyses them into elements, at the same time unavoidably partially transforming them, replacing them, in fact, by models, and these elements become separate percepts, become known. Yet they are to a certain extent known as parts of a totality in perception, the remaining parts being subconsciously felt. As the breaking-up process proceeds, the elements undergo successive transformation which make them ever more and more perfect representations of the reality, until the totality in perception begins to take shape as a unity of qualities perceived, a unity of perception, although, as we saw in chaps. ii and iii, this unity can never be completed.

The whole process, as Laurie conclusively demonstrates, consists of nothing but repetitions of the same reason process which discloses itself in the primary synthesis of percipience. The function of reason is not the construction of the subjective world of the half-idealist, to use Professor Royce's expression, but consists simply in knowing and interpreting that which already exists. Separate percepts are collected into totalities which Laurie calls sense-concepts, which are a great advance on the immediately pre-

sented totalities of the attuitional consciousness, but are not yet true rational universals. The Will-Reason now compares these separate percepts, and the comparison is effected by the same reason process as before, the difference consisting only in the mediate, which is Negation (the law of contradiction) in simple percipience, and some other percept in comparison. Generalized or abstract percepts are then formed, and consist simply in the act of percipience and the concurrent affirmation that the percept exists in many; the mediate is the negation of other percepts than that selected as an abstract percept. The generalized or abstract concept, again, is simply a synthesis of percepts and the concurrent affirmation that this synthesis exists in many: the mediate is the negation of other percepts than those selected to constitute an abstract or general concept. The same reason process of percipience is again repeated in the deductive syllogism, the mediate being a general concept; and in the inductive syllogism, in which the mediate is a proposition. Thus we arrive at the demonstration of Laurie's thesis (p. 121):—

"All action of Reason is but a repetition of the primal act of Percipience, and in this rudimentary dialectic movement the whole of Formal Logic [and therefore the whole of pure mathematics] is contained." This dialectic is the mechanism by which we know.

5. Finite Self-consciousness is attained when man realizes himself as a person, a source of self-determined activity. In the course of the reason process the will directs its activity upon the mind process itself, generally in the first place, in and through the relating of the self to other minds, and then, turning the activity inwards, to the thinking subject itself, so that the subject becomes an object to itself. This object is the living unity of movement which is Reason, and the realization by man that Reason is his true self, and that his body belongs to his external

world, is what constitutes self-consciousness. The Self is not constituted by or through the process, but is the process. The realization of this is what comes about through the repeated functioning of the process.

In examining the nature of the reason process as exhibited in the act of simple precipience I have spoken, as is usual, of the laws or principles of reason, as Aristotle called them. They are not, however, laws in the ordinary acceptation of the term *law*, that is to say, a generalization from experience. These so-called *laws* are, as Laurie observes (p. 50), "revealed to us as implicit in the organic process and in their true logical order as moments or pulses of one act—each moment implicit in the other. Let us state the process again.

Anything whatever is either itself (A) or something else (not-A) . . . *Exclusion.*

A is not something else (not-A) . . . *Negation.*

Therefore . . . *Sufficient Reason.*

A is A . . . *Identity.*

The moments or pulses of the single act of percipience are then

Exclusion, Negation, Sufficient Reason, Identity. This reason movement contains implicit within it (p. 20) "several subject-born or *a priori* contributions to knowledge which, further, are universal and necessary predicates of all other content of knowledge and make their appearance as being this". These new cognitions Laurie terms *Dialectic percepts*, because they originate in the dialectic process whereby we know.

In the first place *Being* is implicit in the whole movement, and when held as a percept apart from the phenomenal presentate, it is contentless, undetermined, non-finite, and therefore absolute and infinite, just as it is in Feeling. Being-universal is presented as the Absoluto-infinite ground of actual or possible presentation to sense. The issue of Identity is a revelation

of the Absoluto-infinite as a *determined there*, a particular, and is attained, not as an immediate impression, but as mediated through the reason movement. *Cause* is revealed in the third moment as the ground of the final affirmation, and, since this movement is the necessary mode of all knowing, "it follows that all phenomenal content of knowledge can be to conciousness only as caused; nay further, it is only in and through things that Cause is for us at all. Cause is a dialectic percept, and it is also the objective fact in the total of things" (p. 140). Moreover, "the mediating or causal contains implicit in it issue or End. Thus things are known by us as teleologically constituted—the end of each being itself. Accordingly, Being, the Absoluto-infinite, Cause, End, are all thrown into consciousness by the Reason-process as pure percepts: and further, so thrown in as to constitute them ampliative or synthetic *a priori* predicates of all possible content furnished to Reason as *data*."

Of these four *dialectic percepts*, Being alone is involved in each moment of the Dialectic, or Reason-movement. Being is, therefore, the only true universal.

The primary activity of Reason in which these dialectic percepts are revealed is first and always found and affirmed in things, and apart from things no affirmation is possible. What we find vaguely in feeling is not contradicted but organized and unified by Reason. Without the dialectic percepts or *a priori* categories, nature, which would then be expressed by the categories of recipience only, would form a mere anarchic mass of unrelated sense impressions. It is the *a priori* categories which correlate and unify this mass, and so furnish the formal scheme of nature which awaits phenomenal filling by scientific research. The formal scheme of nature revealed in the primary activity of Reason is, therefore, revealed

from the first as the universal immanent Reason. The formal dialectic is the real of finite reason and the real in the universe. In other words, "the Universal Mind in nature, by becoming conscious under finite conditions, constitutes Human Reason, and accordingly, Reason in nature and Reason in man are identical" (p. 258). This provides a complete philosophical justification of the declaration of the Hebrew seer, that "God created man in His own image".

"Man in seeking to know nature is in truth seeking there the reflection of his own reason. Having found this, he at once sees that his individual reason is again itself but a reflection of universal reason. The Universal Mind in nature, thus discovered, is God—that is to say, God as Being and Reason, or Beënt Reason (Absolute-Causal Being). Apart from this, there are physico-theological and ethico-theological considerations which have their due place in our final notion of God."

This is the conclusion of Dr. Laurie's argument, and it will be seen that the conclusion is identical with that already arrived at by other lines of thought, and is therefore confirmatory of them. It will be seen also that the continuous development of consciousness is satisfactorily accounted for by the theory of the ever-increasing influx of the Universal Mind into a series of organisms developing, under the influence of the Universal Mind, in such manner as to become suitable receptacles for the influx at every stage. The appearance of Reason as an individuating principle I shall presently consider further, but before doing this I must deal with the final stage of the developing consciousness.

6. *Universal Consciousness, God-Consciousness*, or *Infinite-Self Consciousness.* As I have stated elsewhere[1], "The Eastern student of philosophy subjects himself to a long and severe course of bodily and

[1] *Problem of the Universe*, p. 503.

mental training designed to enable the higher elements of the intelligence to obtain control both of the bodily functions and of the lower elements of the intelligence itself. It is with this sole object that the Brahman, after having fulfilled the ordinary duties of a citizen and of family life, retires to a life of abstinence and contemplation, seeking to realize the self; that is to say, to attain to that higher stage of self-consciousness in which subject and object are both actually realized as essentially one, not only with each other, but with the Eternal Self-Consciousness, constituting the ultimate reality known [to him] under the designation of Brahm. When this is once realized, the Absolute is recognized as being the essential reality, in comparison with which the lower reality of the phenomenal world is but an illusion. This realization necessarily involves the recognition of his own true self, freed in mental vision from its phenomenal environment, as identified with and included within the higher self-conscious unity, or ultimate reality, of which the universe of nature is but the phenomenal manifestation."

When the power of controlling the mind has been achieved, the conscious realization of unity is attained by inhibiting attention to all sense impressions and directing the attention upon the self. The procedure is thus simply a progressive simplification of consciousness effected by bringing the mind under complete control of the will. Records of the experiences of the greater saints and mystics of the most varied faiths show that this unity is attainable by religious contemplation; and there is nothing surprising in this, for the final aim of philosophy is the search for God, which is also the aim of religion.

The study of comparative religion shows that the religious consciousness in its lower, and presumably earlier, stages manifests itself as a realization of a relation between the self and a higher self, or higher

selves, underlying observed phenomena. Moreover, as Professor William James has shown [1], the development of the religious consciousness in its many diverse forms consists essentially in a gradual simplification of consciousness. When the ultimate unification is attained solely by the intuitive development of the religious consciousness, the finally unified conception of the Eternal Self-Consciousness, that is to say of God, is arrived at through mental presentations which differ widely in the votaries of different religions, being coloured by the pre-existing religious belief of the individual. The final complete unification is, however, the same in all cases, and is identical with the results obtained by purely philosophic thought. Moreover, after making due allowance for local colouring due to varied religious beliefs, and also for the impossibility of adequately expressing such experience in words, the similarity in the character of the later stages is most striking.

Universal Consciousness is a condition which is usually attainable only transitorily, but the effect of its occurrence, even on a single occasion only, is, and must be, in the first place, that the subject of this experience *knows* God, in experience, as more fundamentally real even than the finite reality of his own existence. In the second place, this absolute knowledge of God in His infinity, as unlimited knowledge, wisdom, power, and pre-eminently as superabounding love, cannot, and does not, fail to provide those who are privileged to experience it with a deeper and wider foundation than is otherwise attainable for their outlook upon life, and so to increase their capacity and will to help their fellows. This help cannot, however, be given by the universally conscious self as such. The unity of the self with the Universal, Eternal, Self-consciousness is realized only by the complete displacement from consciousness of all limitations, and

[1] *Varieties of Religious Experience.*

it is only through these limitations, the relations existing between the self and the rest of finite nature, including other finite selves, that the self can perform its allotted part in the scheme of finite nature.

The individuation of mind as a distinct self consists in the emergence of Reason as a spontaneous, self-determining activity. The material structure of an organism may be compared to a musical instrument through which the mind, as player, finds expression. The non-rational mind, being receptive merely, can produce only such notes as arise from the impressions which it receives: it reproduces a tune in much the same way as a mechanically actuated piano-player. The rational mind, on the other hand, may be compared to a member of an orchestra, who, although he can only play his part by following the guidance of the conductor, may play that part well or ill according to the manner in which he interprets the conductor's signals, and according to the manner in which he has qualified himself for such interpretation by the acquisition of knowledge of music in general and of mastery over his own instrument in particular.

According to the argument developed in this volume, the emergence of reason which individuates the human mind and constitutes a person, arises at a definite point in the steadily increasing influx of the Universal Mind into the developing sequence of organisms. Its appearance requires explanation, and it is not sufficient to say that it is due to the Will of the Universal Mind, of God, of the Absolute. We have seen that God, as the Absolute or Ultimate Reality, is Being, that Being is Universal Mind, and that Omniscience is a necessary aspect of Universal Mind. Will has made its appearance as the initiating moment of the finite movement of Reason in pursuit of knowledge, while the knowledge of the Absolute cannot be conceived as other than immediate. Further the complexity of the Will as observed in the

human mind obviously arises out of finite conditions. Not so, however, the fundamental aspect of Will, Attention, which is involved in the whole Reason movement; and Professor Royce shows that Attention is a necessary aspect of the Absolute Consciousness. He presents the argument in several forms, well worthy of careful study. I must be content with a very brief presentation.

1. The Absolute thought, or God's thought, forms one whole system with no uncomprehended ideas beyond the system.

2. The contents or data of the Absolute experience, or God's experience, fulfil these ideas, so that there is no object in God's thought that is not possessed as present; or, to express it in finite terms, no wish ungratified, no ideal unfulfilled.

Now the possibilities of bare thought are, of logical necessity, abstractly unlimited, and so exceed the content of any whole realized in experience. But God's ideas, being completely fulfilled in the single system which constitutes the Whole of Reality, the passage to new cases would make no addition to the genuine perfection of His experience. God would not therefore be perfect, would not be the Absolute, if He continued to seek, in hopeless repetitions, for truth that lay always beyond. For such search would involve either an ignorance on God's part that nothing novel was thus obtained, or a blind fate that drove Him helplessly further. The ignorance He would escape, on the hypothesis that He knew the situation. He would escape the blind fate if His ideals were all fulfilled. The fulfilment of the ideal of escaping from the blind fate would, however, involve the presence in Him of the will to arrest Himself, or to be arrested, at the existing Whole of Reality as a single whole of experience. That is to say, the perfection of God's consciousness must involve Will in the form of attention, God's will

meaning, in this case, an attention dwelling upon the actual Whole of Reality to the exclusion of the barely possible wholes which would remain unreal because God's attention left them unreal.

Professor Royce points out that another name may be given to the present aspect of God's consciousness, viz. Divine Love. For, just as Will may be generalized as the process, or aspect, of selective attention in consciousness, so Love also may be generalized as an affection or colouring of consciousness which involves a selection of some content as valuable for reasons which can no longer be abstractly defined in terms of this content, or in terms of its mere contrast to the contents to which it is preferred, be these contents actual or possible. A beloved object, as such, is *experienced* as a datum, is *known* as embodying ideas, but is *preferred* by virtue of characters that remain, despite all knowledge, undefined and in some respects undefinable. What is clear to the loving consciousness is that *no other* object fills just the place, or could fill just the place, occupied by the beloved object. Now, in viewing the world as the object of the love of Absolute Being, one supposes the Absolute Consciousness to contain a moment or aspect that conforms to and exemplifies this generalized definition of Love. This world has a value from the absolute point of view such as no other world, conceived as an abstract possibility, would have. And while this value is, up to a certain point, explained and defined by the fact that the world fulfils these and these specific ideals, one aspect of the matter remains always unexplained, namely, why some other world, with a different sequence of data, might not fulfil, just as well, the same ideas. The selection of this world as the one fulfilment of absolute ideas and ideals would involve, then, an unexplained element. This element is precisely the one that might be expressed as the actual Divine Love for *this* world.[1]

[1] *The Conception of God*, p. 215.

Now the object of Love or Will is, as such, an individuated object, so that we are led on to consider the meaning and nature of individuation and individuality, a matter of fundamental importance from our present point of view, since some thinkers maintain that real individuality is inconsistent with the immanence of God in the universe, and the reality of the individual is essential to the existence of moral responsibility.

The world as observed contains various kinds and degrees of segmentation, and any segmented mass is sometimes called an individual, of higher or lower grade. But the logical individual is not the segmented as such, but the unique as such. An individual is such because its ideally intelligible nature determines the universal to an essentially unique expression. Professor Royce, by means of an able analysis, following a critical examination of the scholastic views of individuation as represented by St. Thomas Aquinas and Duns Scotus, proves that the individual is indefinable by thought, and unpresentable in experience. The concept of the individual, in its primary and original sense, is an ethical concept. Man individuates the objects of his knowledge because he is an ethical being, and no other conclusion is possible than that God individuates the objects of His own world, and knows them as individuals, for no other reason. "Human love is a good name for what first individuates for us our universe of known objects. We have good reason for saying that it is the Divine Love which individuates the real world wherein the Divine Omniscience is fulfilled." [1]

The way by which Professor Royce arrives at this result is simple enough. He points out that a child's first ideas are all unconsciously universal, or vaguely abstract, ideas, and were he *merely* a theoretical thinker he might develop indefinitely his knowledge of the world in which he lives without ever reaching the

[1] *The Conception of God*, p. 259.

knowledge of true individuality. But he has another side to his nature. He has a toy which he loves, say a lead soldier. He breaks it and refuses to be comforted by the gift of one exactly similar, although he becomes perfectly happy again if the broken toy be mended for him. If the toy had been broken and replaced by another, he would never have recognized the loss. "It is not, then, that he theoretically recognizes this simple lead soldier as observably unique in type or as definitely different from all others. It is true that his love for his toy is, in its subjective, instinctive, preconscious type, an *exclusive passion*; that is, a feeling such that the idea of the two objects that shall at the same time be conceived as equally possible satisfactions of this feeling, is a repugnant, a hateful idea. Now at this moment, I say, when the child rejects the other object—the other case that pretends to be an apt appeal to his exclusive love for the broken toy—at this very moment he consciously individuates the toy. And he does this because he loves the toy with an exclusive love that *permits no other.*" In the same way the exclusive love of God individuates the idea of the moral self. The love of a lover for one beloved, and one only, individuates both the lover and the beloved. So also the mother's love for her child is exclusive, and individuates both mother and child.

Passing from the world of our knowledge to the world of reality we may imagine God as saying: "There shall be but this one world", and for Him this world becomes a fact, the oneness being the mere outcome and expression of His will. It is the same for the various individuals within the world who are individuated by God in that each one of them is the object of the exclusive love of God, as filling a place which can be filled by no other in God's experience, which is God's self-consciousness. We thus arrive at the conceptions that:

God is self-conscious individually, and the only

ultimately real individual, because the only ultimately and absolutely whole individual. As such God is unique, embodies one Will, and realizes this Will in the unity of his one life.

Every finite moral individual is just as real and self-conscious as is required by the moral order. Every finite, moral, and self-conscious individual is unique, and in his own measure free, since there is an aspect of his nature such that nothing in all God's universe, except his own choice, determines him, in this aspect of his nature, to be whatever he is, and since no other finite individual could take his place, share his self-consciousness, or accomplish his ideal. These finite individuals are not, however, *whole individuals*, for each of them needs all the others. But, as Professor Royce expresses it (pp. 273, 4), "the freedom of each finite moral individual is part of the Divine freedom—not an absolutely separate part, but a part having its own relative freedom—a differentiated element of this freedom itself. The uniqueness of each moral individual is a *part* of that which renders the Divine life, in its wholeness, unique. The self-consciousness of each finite individual is a portion of the Divine Self-Consciousness. The One Will of the Absolute is a One that is certainly and organically composed of many. . . . The One Will stands differentiated into many, because in such variety of ideals there is greater significance than in a merely dead and abstract unity. . . . The sort of dependence which each individual thus constituted has upon other individuals, and upon the Whole is precisely the sort of dependence demanded by the moral world, namely, the dependence involved for me when I say that unless I, in my private capacity, will what harmonizes with the Absolute Will as such, I shall be overruled by the other wills that (in that case, *despite* me) harmonize in the Whole."

Even the Absolute Unity itself is seen to be essen-

tially inclusive of various interrelated forms of Absolute Self-Consciousness. The Absolute as Seer of thought fulfilled, and the Absolute as Thinker whose ideas refer to and aim at this very seeing or insight itself, together constitute two conscious and contrasted aspects of the Absolute Unity which may be regarded as mutually related selves. Therefore, according to Professor Royce (p. 302): The Absolute, in the only logically possible sense of the term, is through and through pervaded by self-consciousness. That is, the Absolute Unity is the unity of a variety of mutually interrelated and interpenetrating conscious functions, which, while contrasted, essentially refer to one another, and are fulfilled each in and through the others, so that they may well be called, by virtue of the contrast, conscious Selves, each being conscious that the other Selves, his Divine fellows, are in essence but himself fulfilled and wholly expressed. Human individuality, or personality, is therefore a finitization or finite expression, or manifestation, of the Eternal Individuality, just as human reason, which we have seen to be identical with the reason immanent in the manifested universe, is a finitization of the Eternal Reason; and the human will a finitization of the Eternal Will, and therefore the freedom of the human will a finitization of the freedom of the Eternal Will. Personal human immortality follows from this as a necessary consequence, so that we have arrived at a positive solution of the three great problems of philosophy—God, Freedom, and Immortality—and I will now marshal the arguments for each.

GOD.

1. Some realization of a relation existing between the individual self and a higher self or selves underlying the observed phenomena of the external world is practically universal among all the races of mankind.

2. The existence of God as Love, Knowledge, and Power, eternal and infinite, and therefore as Universal Mind, is testified to as an actual experience in consciousness by the thinkers and seers who have attained the stage of universal consciousness or God-consciousness. Belief in the existence of God is then replaced by actual knowledge, and those who have attained this experience can no more doubt the existence of God than they can doubt their own existence.

3. The scientific evidence establishes as firmly as scientific evidence can establish anything, the existence of Universal Mind of sufficient power and intelligence to build up the observed universe from its given energy content, or alternatively, to maintain it eternally as a conservative system.

4. Hegel's analysis of mind and the argument of his *Logic* complete the scientific evidence by showing the energy content of the universe to be a manifestation of Universal Mind, and by showing that this Universal Mind is self-determined, and therefore infinite.

5. The analysis of the reason process as exhibited in percipience shows that human reason is identical with the reason immanent in the observed universe, and that the ground of the existence of this universe, including man, is God as Being, and moreover, that Being is Universal Mind.

6. God, as Complete Experience, *is*; for the denial of this statement involves self-contradiction. Each of these arguments shows God to be immanent in the universe, and the philosophical arguments (4, 5, and 6) show that He is also transcendent, while (4) and (5) show that the universe is a finite manifestation of God.

FREEDOM.

The freedom of the will is shown in (4) and (5) to be a necessary consequence of the observed

reason process, while in (3) it is shown to be a consequence of observed physical data. It is, moreover, a direct datum of consciousness. The physical argument shows that the system of nature, as observed, is not a uniquely determined mechanism, but that any observed change may be effected in an infinite number of ways. It therefore shows that there is room in the observed system of nature for the interplay of free wills of the character required by the moral order without any interference with observed physical laws. Moreover, the existence of such wills does not introduce any philosophical indeterminism into the Absolute; for the Absolute, as Universal Mind, includes all these individual wills within its own Unity.

IMMORTALITY.

The universal, or almost universal, conviction, which history and modern anthropological investigation alike show to exist, and to have existed, amongst all the races of man, in personal immortality is in itself of evidential value, and, in the absence of evidence against it, affords at least a strong presumption of its validity. It ranks, in fact, with the evidence for God's existence which is afforded by the general consciousness of mankind. Man, being a part of nature, his intuition is a part of the organized knowledge of nature which we call science. When universal consciousness, or God-consciousness, is attained, the belief in immortality passes into knowledge which no argument could either strengthen or weaken. This evidence, moreover, like the corresponding evidence for the existence of God, is reinforced by cogent rational argument. Where the intuitional convictions are sufficiently strong, the personal certainty of their truth is greater than can be produced by any reasoned argument, but the intuitional evidence is comparatively unconvincing to those in whom the

intuition itself is weak, or perhaps entirely wanting. I have therefore arranged the five arguments which present themselves to my mind in support of personal immortality in ascending order of cogency, as they appear to me to appeal to the average mind, being the same order in which the arguments for the existence of God were arranged.

1. The general intuition of mankind supports the expectation of personal immortality.

2. With the attainment of universal consciousness, or God-consciousness, this expectation passes into certainty—into actual knowledge.

3. The reason process in the manifested universe has been found to be identical with the reason process of the human mind, which is purposive or ethical. The observed movement of the universe, the process of creative evolution, must therefore be ethical. Now men of science are absolutely unanimous in inferring from the scientific investigation of nature that life must eventually become extinct upon the earth. If this involved the extinction of man, who is the highest product of evolution as far as our earth is concerned, there would appear to be no possibility of avoiding the conclusion that the evolution process, as far as the earth is concerned, is without ethical purpose. It would, in fact, resemble a railway with its terminus in the midst of the desert, or upon a rock in mid-ocean.

4. The individuation of man by the spontaneous activity of Reason, or Will-Reason, as Dr. Laurie very happily terms it, constitutes him a Self having a specific determination of its own; that is to say, having a real independent existence of its own. We have seen, moreover, that the origination of such an individual existence can be accounted for only as the operation of God's Will in the form of Love. This existence can therefore become extinguished only through God's Will ceasing to regard it as an object

of its Love, and it is simply unthinkable that such a result should be effected by the disintegration of the material body through which the individual self functions throughout a certain portion of the time process.

5. We have seen that End, or Purpose, is inherent in the human reason process, even in the most elementary form of percipience. At the initiation of the reason movement this End is undefined, empty of content. It soon, however, acquires some content through the operation of the reason process in the field of experience, and the end then becomes an ideal. In the earlier stages such ideals are of a very elementary character and perfectly capable of being fulfilled within a single earth-life of the individual, but the mind in its higher developments acquires ideals which are incapable of fulfilment within such a life of the individual, and, in the case of the more highly developed minds, are incapable of fulfilment within the limits of the time process itself. They cannot, however, remain unfulfilled, for the existence of unfulfilled finite ideals would involve the presence of unfulfilled ideals in the complete experience, which would be a self-contradiction. It follows that it is a fact that all human ideals are actually fulfilled in the Absolute, in the Complete Experience. This does not by any means imply that all human expectations will be fulfilled. What it does necessarily imply is that there is no human ideal, and consequently no human self, which is essentially and entirely evil, as will become evident if we consider the meaning of the terms Good and Evil.

We have seen that in the Absolute all experience harmonizes into a complete whole, and that this completeness is the expression of the Absolute Will as Love. Two alternative methods only are conceivable to us by which such a complete whole of harmonious experience could be manifested in a universe of finite

wills each of which is a centre of spontaneous activity. (1) Every one of these free individuals might employ its freedom only to surrender it by absorption of its individuality into the Universal Mind. There would then be no conflict of wills, and consequently no intrusion of discord in the time process. Every component portion of the universe would fulfil the law of its being, and throughout the process the harmony would be unbroken, but it would no longer be a universe of individuals. (2) The complete whole of the Absolute experience might be attained in and through a conflict between the individual wills, which conflict would manifest itself as discord in the time process.

Observation teaches us that the second alternative represents the actual conditions in the existing universe. It teaches us further that every portion of the universe, with the exception of the free individuals within it, is constrained to fulfil the law of its being under the action of external control by the Universal Mind. The free individuals, however, are only partially guided in this manner, very largely by pain, which experience shows to be nature's warning to an organism that it is deviating from the due fulfilment of the law of its being. Under the influence originally of the teaching of pain and the constraint of external conditions only, the developing free individual learns to conquer nature by learning her laws and conforming himself to them; that is to say, by learning the law of his being, the law of God. As his development continues, the part played by external control gradually diminishes, giving place to the influence of reason and the higher ethical faculties of man, and with the development of these faculties he feels himself ever more and more impelled to seek out the law of his being and endeavour to conform himself thereto.

In the earlier stages of this upward path towards

self-realization through the development of character we find that the hostile environment which appears to the superficial mind to limit, if not to negative, either the power of God over the world of His creation or His love for it, is essential to our progress, for without the spur to action provided by such an environment we should rest content with ourselves and our surroundings. In the later stages, when the ethical faculties have been sufficiently developed, the hostile environment is still as great an aid as before, but now it operates mainly by furnishing the developing individual with an incentive to continue the struggle on behalf of his weaker less developed fellows, and thereby to carry on his own development to still higher stages.

Without experience, man would be a mere formal self, empty of content. The growth of self-realization consists in the acquisition of content in and through experience; and once the self is formally constituted, the process of acquiring experience ceases to be one of mere absorption, for the creative will, which is the self, takes possession of the experience, transmutes it into forms in which it can be assimilated, and finally assimilates it. This holds, not merely for experience of inanimate nature, but also for experience of conscious, and self-conscious, nature. The impulse by which this growth is determined, and which impels man consciously to seek to discover the law of his being, and when discovered to fulfil it, is the moral imperative, the sense of ought; in other words, the voice of conscience. Conscience is, therefore, initially an activity and not a guide, and can have no other source than the Will of God as Attention, or Love, which has been shown to be the source of the individual self. Conscience impels man to seek the right course, that is to say the course by which he can fulfil the law of his being, and press forward in the path of self-realization. It

does not, however, indicate the path. This is discoverable primarily only through experience taken possession of by man's creative will, or reason. This path is essentially that of the development of personality, the path of ever-increasing effort. For throughout the process of self-realization, or the development of personality, the passive element in the acquisition of experience steadily diminishes relatively to the steadily increasing active element.

The influx of the Universal Mind continues throughout the process, and at an ever-increasing rate, the creative evolutionary process being of such a character as to draw out the personality—to assist its development—by impelling (but not compelling) the developing man to exert his own creative will ever more and more strenuously; that is to say, the man is impelled ever more and more to stretch out consciously in the search for God, to which God in the process of creative evolution, as the Universal Mind, always responds, through both external and internal experience. The man thus finds no rest until he succeeds in lifting himself up to the apprehension of God as immanent in the All and as the source of the All; and it is then only that he rises to the status of a fully self-conscious ethical being. If, however, man ceases from stretching out and looks backwards, he ceases to progress, enters upon a path of regress in which the activity of the will-reason gives place to prerational passivity, the animal instincts become once more preponderant, and we have an illustration of the eternal verity presented in the parable of the fall of man. Such a man may even lose the original intuition of the existence of God, and sink into Atheism.

Evil, for any living organism, is seen to consist in deviation from the law of its being, and when deviation is effected consciously, through the purposive activity of the will, it becomes moral evil,

which the theologian calls sin. A man who persistently and deliberately chooses evil in preference to good may not only lose the intuition of God, but may sink below the level of the beast and learn to love evil for its own sake.

The complete good for each, as for the All, is now seen to consist in the harmony of all the parts under the domination of God's creative idea. This idea unfolds itself and reveals itself to man only in so far as in his upward striving he succeeds in fitting the various parts, piece by piece, into their relative positions, and it is in this manner that the harmony gradually develops. Pleasure is, in itself, good; but the pursuit of pleasure as an end does not lead to the harmony through which alone the highest pleasure is attainable, so that the pursuit of pleasure as an end defeats its own object. The pursuit of harmony as an end is the ideal of duty, and therefore, in an anarchic world, the concept of duty would be as meaningless as that of harmony.

Since the animal mind does not attain to personality, there would be no meaning, strictly speaking, in asking ourselves the question whether personal immortality be possible in the case of mere animals. They are segmented units, but not individuals in the philosophical sense. Yet we may quite legitimately ask whether the segmentation of mind universal which functions through the body of an animal may not have a continuing existence after the disintegration of the animal body. Neither science nor philosophy nor the religious consciousness can have anything to urge against it. On the other hand, there does not appear to be any definite scientific or philosophic evidence in favour of it, except that its negation would appear to involve a wastage in the process of creative evolution.

It will be observed that, although the cumulative effect of the arguments for the existence of human

personal immortality is overwhelmingly strong, those arguments, except that of general expectation and that of wastage, do not apply to the continued existence of human beings who have not attained to anything that can truly be called personality. Such human beings have not risen above the animal stage, so far as can be ascertained from observation, and therefore neither science nor philosophy can supply any evidence in support of their continued existence which would not equally apply to the animal world in general.

CHAPTER VI

BERGSON AND BRADLEY

SUMMARY

Bergson's philosophy was the first serious attempt to develop a philosophy of evolution and, so far as at present developed, it does not penetrate beyond the sphere of evolution, and does not, therefore, come into contact with Ultimate Reality, but with Phenomenal Reality only.

Bradley's criterion for the distinction between Appearance and Reality—the presence of self-contradiction in the former and its absence from the latter. Criticism of Bradley's exclusion of Will from the Ultimate Reality. Bradley's failure to recognize the Real Self in Man.

Bergson's support of the position that the phenomenal universe is a unity—not an aggregate of elements. His view that the human intellect has been developed primarily in response to the needs of action. His inference that the intellect is unreliable as a guide in the sphere of abstract thought shown to be negatived by experience. Bergson's complete disposal of the Eleatic paradoxes accompanied by a failure to perceive that space, as well as duration, must be transformed before it can become measurable. Criticism of his contention that duration is ultimately real.

Bergson's powerful advocacy of Free Will, and support, as far as he goes, of the view of perception presented in chap. v, and of the Complete Idealism, or Natural Realism, there presented: his criticism of both Subjective Idealism, or Half Idealism, and of Materialistic Realism. His illuminating treatment of Memory, with the distinction between *pure memory* and *memory images*. His conception of the relation between past and present.

Bergson's conception of creative evolution as a continuous creation of new forms which are not determinable in terms of pre-existing conditions. Histologists, embryologists, and naturalists less prone than physiologists to the explanation of vital action in terms of physico-chemical data, and the reason thereof.

Criticism of Bergson's hypothesis of a developing God and his rejection of the Absolute. His destructive criticism of the purely mechanical view of life. Schäfer on the phenomena of living matter.

THE philosophy of Henri Bergson is attracting such widespread interest at the present time that this

alone would demand, almost of necessity, some attempt on my part to indicate its bearing upon the presentation at which we have arrived. For this purpose I may confine my attention to the three profoundly illuminative works, *Essai sur les données immédiates de la conscience*, *Matière et mémoire*, and *L'Évolution créatrice*, which contain its essentials as far as at present developed. They are throughout most intensely interesting, and are marked, not only by clear thinking, but by such clearness and simplicity in expression as to make them accessible to a far wider circle of readers than the great majority of philosophical works.

The philosophy of Professor Bergson is a philosophy of evolution, being, as far as I am aware, the first serious attempt to develop such a philosophy; for, as Bergson points out with perfect justice, Herbert Spencer's contribution to the subject was confined to an elaborate dissection of evolving nature into fragments, followed by a fitting together of the fragments into a structure from which the whole movement of life had been eliminated [1], and such a method could never lead to any real philosophy of evolution. So far as at present developed, Professor Bergson's philosophy does not extend beyond the sphere of evolution, and so does not come into contact with ultimate reality. The term reality as employed by him must therefore be regarded as standing for phenomenal reality and not for ultimate reality. It does not extend to God as Absoluto-Infinite Being, but presents, as the highest reality with which it deals, a growing, that is to say a developing, manifestation of God in the phenomenal universe of physical nature. Professor Bergson would not admit the validity of the contention that a developing reality cannot be ultimate, but that it must be essentially an *appearance*, in the sense in which the term is employed by Bradley [2], viz. any one

[1] *L'Évolution créatrice*, pp. 393–4.
[2] *Appearance and Reality*, by F. H. Bradley, LL.D.

of the varying degrees of phenomenal reality, that is to say, everything which is not ultimate reality. Bradley's criterion of ultimate reality is that it cannot be self-discrepant, so that the presence of self-contradiction in any aspect of reality must be accepted as showing that it cannot be an ultimate aspect. Everything phenomenal is somehow real, but in so far as self-contradiction is involved in it, can enter into the Absolute only through transformation. The examination of various aspects of reality leads Bradley to the conclusion that [1]

"There is but one Reality, and its being consists in experience. In this one whole all appearances come together, and in coming together they in various degrees lose their distinctive natures. The essence of reality lies in the union and agreement of existence and content, and, on the other side, appearance consists in the discrepancy between these two aspects. And reality in the end belongs to nothing but the single Real. For take anything, no matter what it is, which is less than the Absolute, and the inner discrepancy at once proclaims that what you have taken is appearance. The alleged reality divides itself and falls apart into two jarring factors. The 'what' and the 'that' are plainly two sides which turn out not to be the same, and this difference inherent in every finite fact entails its disruption. So long as the content stands for something other than its own intent and meaning, so long as the existence actually is less or more than what it essentially must imply, we are concerned with mere appearance, and not with genuine reality. And we have found in every region that this discrepancy of aspects prevails. The internal being of everything finite depends on that which is beyond it. Hence everywhere, insisting on a so-called fact, we have found ourselves led by its inner character into something outside itself. And this self-contradiction, this unrest and ideality of all things existing, is a clear

[1] *Appearance and Reality*, p. 455.

proof that, though such things are, their being is but appearance. But, upon the other hand, in the Absolute no appearance can be lost. Each one contributes and is essential to the unity of the whole."

The general conclusion that Reality is one system which contains in itself all experience is certain, for it contains all possibilities, so that to doubt it is logically impossible, as was fully brought out in chap. v, when dealing with Professor Royce's presentation, which may be considered as an extension and development of Bradley's. The most important development consists in Royce's demonstration of the presence of Will in the Absolute. Bradley finds himself unable to ascribe Ultimate Reality to Will, or even to accept it as supreme in and over thought. This attitude appears to me to be due to his having viewed Will only as the psychophysical complex which constitutes the experimentally discerned finite human will. Attention, which we have seen to be the fundamental aspect of will, contains no self-discrepancy, and was seen in chap. v to be essentially Real. The emergence of attention as the fundamental aspect of will is directly revealed in consciousness in the passage from ordinary reflective self-consciousness to universal consciousness, and the supremacy of will over thought is revealed simultaneously in that the passage is effected by the complete suppression of reflective thought by the will consciously recognized as concentrated attention.

It is in universal consciousness only that the Real Self emerges and is known as Reality, as Absoluto-Infinite Being itself, God underlying, indwelling, and sustaining the finite self. The finite self alone appears in ordinary self-consciousness, and Bradley's search for the self being limited psychologically to the sphere of finite self-consciousness, naturally finds appearance only.

We have seen in earlier chapters that the phenomenal universe is not an aggregate of elements, but

unity which cannot be decomposed into elements without essentially transforming it, so that the procedure of physical science consists in the construction of a series of models, approaching ever more nearly, but never actually attaining, to a complete representation. This is clearly apprehended by Bergson, and lucidly demonstrated and illustrated in his works. His most fundamental conclusion is that the human intellect has been developed in response to the needs of the body for action upon its surroundings, and that the intellect is, in consequence, primarily adapted for action and comparatively ill-adapted to the acquisition of knowledge except in so far as required for action. He therefore regards the intellect as a very imperfect instrument of abstract thought, and considers intuition, or the direct appeal to consciousness, as the final and only trustworthy tribunal in the sphere of knowledge.

I consider that Bergson makes out an exceedingly strong case for his contention that the human intellect has been developed primarily in response to the needs of action, and I admit that this gives *a priori* probability to his inference that the intellect cannot be expected to prove a reliable guide in the higher regions of abstract thought. Inference must, however, give way to actual experience, and I maintain that the considerations developed in chap. v definitely establish the reliability of the intellect as a final court of appeal even in the highest regions to which intuition can attain. For here the verdict of the intellect is in absolute accord with that highest intuition in which consciousness actually expands into Absoluto-Infinite Being itself. For in the universal consciousness, from which sense perception and reflective thought have disappeared at the command of the will, space and time are both eliminated. There is neither here nor there; neither before nor after; only the permanence of absolute unity. Time and space have dissolved into eternal peace. Will is present

as boundless love, and so also is a feeling of boundless power, but these are not felt as distinct attributes of the eternal peace, although they can be expressed, in finite terms, only as attributes. The inference which I draw from this proof of the capacity of the intellect to accompany the spirit of man to the highest pinnacle of the knowledge which reaches it through intuition and to confirm its accuracy, is that while the call for action is the instrument by which the intellect is developed and trained in its earlier stages, the purpose of this development, latent in the Eternal Idea and now manifested in the time process, is the attainment of all knowledge, the spirit of man ever reaching upwards to receive the inflow of intuition from the Universal Mind, from the Eternal Spirit itself, and the intellect keeping pace with the spirit by the growth of its capacity of testing the truth of the interpretations by the finite spirit of the self-revelation of the Infinite Spirit.

The concepts of measurable time and space are simply manifolds, the former being a manifold extended in one dimension, while the latter is extended in three.[1] In the actual world we have duration and extensity, neither of which is measurable without transformation. The relation of measurable time to actual duration and the absurdities which result from confusing them are very clearly explained by Bergson in the first and second of his above-mentioned works, but he describes this confusion as the spatial representation of duration, and does not appear to recognize the similarity of the transformation which must be effected in both duration and extension, or extensity, as he calls it, in order that they may become measurable. In his first work, which is translated into English under the title "Time and Free Will", he takes these as the fundamental data of consciousness, but does not appear to regard extensity as equally fundamental with duration. The

[1] See *The Problem of the Universe*, pp. x–xii, and p. 524.

substitution of the phenomenal realities duration and extensity for measurable time and space, while it disposes of some self-contradictions, such as the paradoxes of Zeno and the Eleatic School, does not provide an answer to Bradley's arguments, which show that neither duration nor extensity can be Ultimately Real since both are self-discrepant. And here the appeal to the higher consciousness, as we have seen, confirms the verdict of the intellect, and destroys all foundation for Bergson's contention that duration is to be regarded as Ultimately Real.

In the case of Free Will the higher consciousness supports Bergson's contention that it is a fundamental datum of consciousness. Moreover, he makes out an extremely strong case for its validity from the point of view of the intellect, although in his argument he handicaps himself to some extent by assuming as applicable to actual matter the complete determination of the mechanical model. This handicap is quite unnecessary, for we have seen that even in matter room is left for directivity by the Universal Mind, and that the exercise of such directivity is essential if the universe be a stable system, and if not, has been essential at some period in its past history.

In Bergson's second work, *Matter and Memory* (English translation), he develops a theory of perception from a standpoint essentially identical with the presentation of chap. v, but dealing only with stages (3) and (4) as there given, viz. Sense-Attuition and Percipient, or Rational, Consciousness. Early in the opening chapter this standpoint is expressed, in the plain and simple language of commonsense, as follows : "All seems to take place as if, in this aggregate of images which I call the universe, nothing really new could happen except through the medium of certain particular images, the type of which is furnished me by my body."

Here Bergson starts with the Rational Consciousness, and divides the aggregate of images forming the subject's external world into two groups: (1) The body-group, including the brain, the afferent and efferent nerves, and the disturbances travelling to and from the brain, from and to (2) the group external to the body. Then what is seen to happen is that movements are transmitted in either direction from one group to the other, but the image called cerebral disturbance cannot really beget external images, for in that case it would contain them in one way or another, and the representation, that is to say the pictured image, of the whole material universe would be implied in that of this molecular movement. The body must, therefore, be regarded as an object destined to move other objects; that is to say, as a centre of action, and cannot give birth to a representation.

Now imagine the body-group of images to be slightly modified by cutting the afferent nerves of the cerebro-spinal system, everything else remaining unchanged. Sense-attuition then vanishes, but, from the point of view of an external observer, what has happened is that the body is no longer able to extract, from the surrounding objects, the quantity and quality of movement necessary in order to act on them. Matter may therefore be regarded as the aggregate of images, and perception of matter as the same aggregate referred to the eventual action of that portion of the total aggregate which constitutes the body-group. Matter then appears as a system of images in which each image varies for itself and in the well-defined measure that is patient of the real action of surrounding images. Perception of matter, on the other hand, appears as a system of images representing the same phenomenal reality, but it is one in which all the images are changed by changes in a single privileged group, the body-group: changed,

moreover, in the varying measure according to which they reflect the eventual action of the privileged group. The former constitutes the world of science; the latter the world of consciousness. Then, as Bergson tells us:

"The question raised between realism and idealism becomes quite clear: what are the relations which these two systems of images maintain with each other? And it is easy to see that subjective, or personal, idealism consists in deriving the first system from the second, materialistic realism in deriving the second system from the first" (p. 14).

To the material realist the world of science, which he posits as real, is a completely determined mechanism, so that the passage to a world largely contingent on consciousness appears as an immersion into illusion. Consciousness becomes an accident, and therefore a mystery which cannot be explained but only concealed by some such word-juggle as the unintelligible materialist hypothesis of the epiphenomenal consciousness. Moreover, the subjective idealist is in a position nearly as difficult; for he has to account for the passage from the highly contingent world of consciousness, which he posits as real, to the far less contingent world of science, so that, as Bergson points out, the scientific representation becomes an accident and its success a mystery. The passage is not here, as in the former case, without exit, but the only exit is, as Bergson observes, by means of an arbitrary hypothesis assuming "some sort of pre-established harmony between things and mind, or, at least (to use Kant's terms), between sense and understanding". From the position set forth in chap. v, which Dr. Laurie calls Natural Realism, and which Professor Royce calls Complete Idealism, the passage is effected without any unintelligible or even arbitrary hypothesis. It is not made, however, by the direct route from one finite system to the other,

but by a longer route. The two physical paths [1] traced out in chaps. ii to iv were completed in chap. v through the region of abstract thought in which mathematical analysis as at present developed is unable to continue its guidance. The two finite systems were connected by relating them through the infinite. It is true that the two systems, matter and consciousness, or matter and mind, were traced down to actual contact, so to say. For the material system was found to be simply energy, and mind was shown to be capable of altering the distribution of energy and of becoming conscious of changes in energy distribution; in other words, of forming mental representations of such changes. We could, however, find no evidence that finite mind could actually evolve energy or absorb it into itself, and it was only when all limitations were removed, so that we had passed from finite to infinite mind, that we could demonstrate their essential identity by showing that energy is included in, and is therefore evolved from, mind. The legitimacy of the final stage of the argument was confirmed by the arguments of Laurie and Royce, which led to the same conclusion, viz. that the human mind is the finitization of the Infinite Universal Mind.

Bergson considers that a study of the progress in nervous organization accompanying the progress in mental development, beginning with reflex-action, and proceeding through sensitiveness and sense-attuition to rational consciousness, shows that the increasing complexity of the nervous system serves simply to increase the power of action of the organism upon its environment and to enlarge the sphere of its action. A comparison of the structure of the brain with that of the spinal cord, which is the seat of reflex action, shows merely a difference in complexity and not a difference in kind. He therefore regards the brain as being no more than a kind of central telephone

[1] From matter towards mind and from mind towards matter.

exchange, its office being to allow communication or to delay it, and to allow the response to peripheral excitation to take place through this or that motor mechanism, chosen, and no longer prescribed, as in reflex action. Living beings are to be regarded, therefore, as centres of action more or less spontaneous, and therefore as centres of indetermination.

Consciousness being Reality is not deducible from anything else; but, as Bergson tells us:

"What you have to explain, then, is not how perception arises, but how it is limited, since it should be the image of the whole, and is in fact reduced to the image of that which interests you" (p. 34).

In order to make the attempt Bergson asks us to imagine "a perception that a consciousness would have if it were supposed to be ripe and full-grown, yet confined to the present and absorbed, to the exclusion of all else, in the task of moulding itself upon the external object". To convert the image of the whole into a representation, some of its aspects must be obscured, "so that the remainder, instead of being encased in its surroundings as a *thing*, should detach itself from them as a *picture*". Now a consciousness under the limitations which we have imagined may be regarded simply as a certain spontaneity of reaction through the brain of the subject. Suppose this brain to be surrounded by a number of the images which we call material bodies. Fluxes of energy will impinge upon the brain from each of them, but of the whole influx that portion only will interest the organism, and therefore give rise to reaction, which indicates the possibility of action upon the surrounding images. This diminution of the several actions of the external images will then, according to Bergson's view, constitute their representations in the consciousness.

"Since the structure of the brain is like the detailed plan of the movements among which you have the choice, and since that part of the external images

which appears to return upon itself in order to constitute perception includes precisely all the points of the universe which these movements could affect, conscious perception and cerebral movement are in strict correspondence. The reciprocal dependence of these two terms is therefore, simply due to the fact that both are functions of a third, which is the indetermination of the will" (p. 35).

This theory of pure sense-attuition unaided by memory, which Bergson calls pure perception, practically identifies matter, in essentials, with the pure sense-attuition of matter, and leads to the conclusion "that the living body in general, and the nervous system in particular, are merely channels for the transmission of movements[1], which, received in the form of stimulation, are transmitted in the form of action, reflex or voluntary. That is to say, it is vain to attribute to the cerebral substance the property of engendering representations." If this be the case, it will follow further that memory in its general form, the recollection of an absent object, will not be explicable in terms of the brain. The cerebral mechanism may, indeed, "in some sort condition memories, but is in no way sufficient to ensure their survival". It may serve to ensure effective action but cannot be directly concerned with representation, and may be inferred to play a similar part in perception, so that the establishment of this theory of memory would verify the conclusion on which it was based.

A further conclusion will be that in pure sense-attuition "we are actually placed outside ourselves, we touch the [phenomenal] reality of the object in an immediate intuition"; and the truth of this also can be tested only by the study of memory. For the difference between perception and recollection will be one of degree only, if the representation of the object

[1] And that means, as we have seen, that they are merely channels for the flow of energy.

is rationally constructed; while it will be a difference in kind if the object is intuitively perceived. From the standpoint adopted in these pages the difference is necessarily one of kind, for in perception there is a flow of energy from the object to the brain of the subject, while there is no such flow in recollection. Further, both Bergson's conclusions involve an identity in essence between matter and mind; and we have seen that this means an identity in essence between energy and mind, which is fully accounted for if energy be accepted as being a manifestation, or aspect, of Universal Mind, as maintained in chap. v.

Bergson then shows that, putting aside for the moment the questions how representations are preserved, and what are their relations with the motor mechanisms, the theory of memory here presented may be summarized in three definite propositions:

1. "The past survives under two distinct forms: first, in motor mechanisms; secondly, in independent recollections."

2. "The recognition of a present object is effected by movements when it proceeds from the object, by representations when it issues from the subject."

3. "We pass, by imperceptible stages, from recollections strung out along the course of time to the movements which indicate their nascent or possible action in space. Lesions of the brain may affect the movements, but not the recollections."

These propositions, regarded at the outset as hypotheses, are supported by an extensive and detailed review of the evidences derived from normal and pathological psychology, and by showing the insuperable difficulties involved in any theory which represents recollections as being stored in the brain.

Bergson applies the term *pure memory* to the memory which recollects, which reproduces our past, duly dated. He points out that when we try to recover such a recollection we endeavour to detach ourselves from

the present in order to replace ourselves in a definite region of the past—"a work of adjustment, something like the focussing of a camera. But our recollection still remains virtual; we simply prepare ourselves to receive it by adopting the appropriate attitude. Little by little it comes into view like a condensing cloud; from the virtual state it passes into the actual; and as its outlines become more distinct and its surface takes on colour, it tends to imitate perception. But it remains attached to the past by its deepest roots, and if, when once realized, it did not retain something of its original virtuality, if, being a present state, it were not also something which stands out distinct from the present, we should never know it for a memory" (p. 171).

These recollections are, however, fugitive and difficult to recover at will. If, therefore, we desire to make a recollection available at will we convert it into a memory image by expressing it in words and repeating its expression often, and preferably also in several forms. For example, in order to memorize a certain sequence of ideas expressed in words we should hear the words spoken, write them down, and read them, aloud if possible, for in this case we should form four distinct motor mechanisms each of which will enable us to *act* the recollection by expressing it in written or spoken words. It will then become a memory-image, no longer dated, but ready to insert itself into our present whenever the existing circumstances call for a repetition of the action, or for its virtual repetition for the use of the intellect. When the action is merely virtual, the sensations which would accompany the real action will remain in the nascent state, but the existence of these nascent sensations clearly distinguishes in consciousness a memory-image, which is habit interpreted by memory, from a pure memory.

In the merely attuent, or animal, subject the

memory images will be the sole means, or very nearly the sole means, by which the subject reacts upon the object, and so diminishes the domination of the latter over the former. In the percipient, or rational, subject this reaction will be largely increased owing to the greater number and complexity of the memory-images at the disposal of the subject. The pure memory will not itself add to the reaction, as far as we know; for finite mind does not appear to be capable of generating energy. Finite mind is, however, capable of changing the distribution of energy, so that the pure memory, by means of the additional information which it places at the disposal of the intellect, will enable the latter to increase the efficiency of the reaction arising from the motor-mechanisms constituting the memory-images by co-ordinating them more completely to the desired end.

Of the two questions put aside by Bergson in formulating his theory of memory, the first, how representations are preserved, has already found a partial answer. They remain in the unconscious region of the mind, and consciousness reaches them by seeking them in the past. The past must therefore continue to exist, and this will raise a difficulty in the minds of some readers, and this difficulty I must endeavour to remove. The second question, what are the relations between representations and motor-mechanisms or memory-images? finds its complete answer in the interaction between mind and energy, which was demonstrated in chap. iv. Now as Bergson tells us (p. 180):

"That which I call my present is my attitude with regard to the immediate future; it is my impending action. My present is, then, sensori-motor. Of my past, that alone becomes image and consequently sensation, at least nascent, which can collaborate in that action, insert itself in that attitude, in a word make itself useful; but from the moment that it

becomes image the past leaves the state of pure memory and coincides with a certain part of the present."

My present, then, is a system of sensations and movements, being in fact nothing else than the consciousness which I have of my body and of the system of images of which it is the centre, the whole forming what we call the material world. Now my body presents itself to me as extended, its sensations and movements being localized at determined points of it. But there cannot be in the same place several things at the same time. There can, therefore, at a given moment, be a single system only of movements and sensations, and this is the sole reason that my present appears to me a thing absolutely determined, and contrasting with my past. To suppose that my past has ceased to exist is to assume that the whole material world disappears and is re-created at every instant, that material objects cease to exist when we cease to perceive them. The present is simply that which is being made, and the past is that which, having been made, is no longer useful from the point of view of action.

In the concluding chapter Bergson endeavours to draw mind and matter together. In the first place, he shows that the material world, like mind, is an indivisible unity, and that the idea of quantity is imported into it in the course of transforming it in such manner as to enable the intellect to deal with it. He therefore confirms the conclusion arrived at by a very different line of argument in chaps. ii and iii. He then endeavours to show that mind has aspects in which it must be regarded as extended, which would still further diminish the apparent irreconcilability of mind and matter. This part of the argument does not appear to me very convincing. It becomes, however, superfluous when extension is regarded merely as appearance, as I maintain it must be. For

extension will then be regarded as merely an aspect under which matter presents itself to the consciousness through the senses. Mind, on the other hand, is apprehended primarily through direct intuition, and does not, in that case, take on the aspect of extension. When approached through matter, mind must necesarily take on this aspect. In Bergson's argument it does so through the localization of sensations in the extended body of the subject. In the argument of chap. iv it does the same, owing to the conception of Universal Mind being arrived at through its observed action on the material universe, which presents itself to us as extended.

In Bergson's most recent work, *L'Évolution créatrice*, of which an English translation has been published quite recently, he first briefly recapitulates his general position, including the complete mechanical determination of matter, which modern physics has shown to be untenable, as was shown in chap. ii. He then passes on to consider the problem of the evolution of life, and sets forth his views of *life*, not as an abstraction, but as a continual becoming, or continual creation, so that its evolution bears a close resemblance to the evolution of consciousness. From the point of view of Weismann's theory of the *continuity of the germ-plasm*, for example, life may be represented as a current flowing from germ to germ through the medium of an organism developed during the flow. And everything happens very much as though the organism itself were a mere excrescence, a bud whose sole function is to provide the original germ with the means of continuing itself as a new germ (p. 29). There is here no mere repetition, Bergson maintains, as in astronomical, physical, and chemical phenomena, but a continuous creation of new forms not determinable in terms of pre-existing conditions. Physics and chemistry can account for so much of the structure of living bodies as consists of mere repetition, as, for

example, in the case of the material of a horn. Hence the tendency of the physiologist to incline towards mechanical views of life. On the other hand, those who are concerned with the origin and development of living tissue in all its detail, histologists and embryologists on the one hand, and naturalists on the other, have to deal with the horn itself and not merely with the material of which it is formed. They are therefore far less prone than the physiologist to the explanation of vital action in terms of physico-chemical data. A very noteworthy exemplification of this tendency of the physiologist is afforded by Professor Schäfer's presidential address at the 1912 meeting of the British Association at Dundee, and I have therefore discussed it from that point of view at the end of this chapter.

A complete mechanism in nature, and this, as we have seen, has been shown to be inconsistent with observation, even in the material universe, would involve complete determination, or, as Bergson expressed it, a universe given *en bloc*, in which there would be no place for duration in any real sense. We have seen, however, that the disproof of complete mechanism does not necessarily import indetermination into the Absolute, which would be to destroy it as Absolute. This determination in the Absolute is rejected by Bergson, who calls it *finalism* (p. 42), and consequently he rejects the Absolute altogether. To do this appears to me inevitably to involve a denial of the universal validity of the law of contradiction, and this is a complete stultification of the intellect. One thinker, at least, has accepted this implication and endeavoured to justify it.[1] Bergson, however, admits that *finalism* can never be definitely disproved, while the doctrine of complete mechanism will be destroyed by the demonstration of the slightest trace of spontaneity in the smallest speck of dust, exhibited by its deviation from the

[1] E. D. Fawcett, in *The Individual and Reality*.

path prescribed for it by the purely mechanical hypothesis (p. 43). The rejection of *finalism* involves, not only the rejection of the completely disproved and now universally discredited hypothesis of complete mechanism, but the rejection also of the conception of the evolution of the universe in accordance with a predetermined plan.

Bergson's working hypothesis is "that life, from its start, is the continuation of one and the same impulse splitting itself up into three diverging main lines of evolution" (p. 57); and after completing his inquiry into its validity, he sums up his conclusions in the statement that "Everything happens as if a being of an indecisive and fluid character, which might be called, at will, man or superman, had been attempting to realize himself, and had succeeded in so doing only by shedding off a portion of himself during the process."

I have quoted this final expression of Bergson's opinion on the interpretation to be given to the observed facts viewed from the standpoint of his initial hypothesis, because it enables me to contrast it with the view developed in chap. iv, and amplified in chap. v, so that the reader may judge between them as we proceed. This view is that the Infinite Universal Mind is itself the direct source of life, and that the course of its evolution is simply the process of progressive finitization by which Universal Mind manifests itself in an ever-increasing degree. If this be the correct view, as I maintain, the imperfections which Bergson attributes to the source of life arise from the limited apprehension of the whole which alone is possible to the finite human mind. If Bergson's view were correct, it would be necessary, in order to reconcile it with what has been demonstrated in this volume, to assume that the evolution of life arises, not from the direct action of Universal Mind, but from a finite mind or spiritual being, far greater than man, this being itself deriving its existence from Universal Mind. Moreover, one such

being in the universe would not be sufficient for the mathematical concept developed in chap. iv, for the minimum powers of such a being requisite for either the maintenance of the material universe as a stable system or for its formation, show that this power would be indistinguishable, as far as we are concerned, from unlimited power, so that it would be quite impossible for us to find evidence of its want of absolute perfection. Bergson's view would therefore involve a hierarchy of spiritual beings carrying on the work of creative evolution throughout the universe, descending through various grades at least as far as tutelary spirits for each and every star, planet, and satellite. The tutelary spirit of our world would be the Demiurgos of Hellenic Gnosticism.

Bergson points out (p. 59) that the purely mechanical view of life would be refuted, and what may be called the principle of vitalism established, if it could be shown that "life constructs certain identical instruments, by dissimilar methods, on the diverging lines of evolution. The strength of the evidence would, moreover, increase in proportion to the amount of divergence between the lines of evolution selected, and to the complexity of the similar structures found on them." At the beginning evolution proceeds in two opposite directions: towards immobility, as shown in the development of plants; and towards mobility as shown in the development of animals. The latter line bifurcates again later, and develops towards the perfection of instinct and the perfection of intelligence, respectively.

The sexual organs of the higher grades of animals and plants are formed of materials differing very widely in chemical composition, and developed under widely differing conditions. Yet the method of fecundation is identical, and the changes in the sexual elements preparatory to fecundation are also identical, consisting essentially in a reduction in the number of chromosomes both in the male and female germ cells,

combined with the rejection of a certain proportion of the chromatic substance. Here we find the closest similarity in so far as this is requisite to the adequate fulfilment of similar functions, while in inessential accessories there is the greatest possible diversity of structure and arrangement, corresponding to the special conditions in each case. Again, for effective vision, the eye must contain a large number of what are practically distinct instruments, each of the greatest delicacy, and all co-ordinated with the utmost completeness. In animals differing so widely as vertebrates and certain molluscs the eyes are found to contain the same essential elements, closely resembling each other. Whence comes the similarity in structure, although the material is of widely different chemical composition in the two cases? Bergson examines the various theories of adaptation. The minute variations of Darwinism; the large variations, or mutations, of De Vries; the partially determined variations of Eimer; the inheritance of acquired characteristics of the Neo-Lamarckians: all are found to be utterly inadequate.

The problem which appears so hopelessly intricate as to be insoluble becomes a simple one when we change our point of view. We regard these various structures from the point of view of action, of being called upon to construct them; and our only method of construction is to build up a structure by adding piece to piece. But we find by watching the development of an embryo that natural growth does not consist of putting together a collection of elements: it proceeds by dissociation and multiplication. When regarded from the point of view of a function to be fulfilled, instead of from that of a structure to be built as by a human workman, the problems become simple.

What is required in sexual reproduction is the union of germ cells from two parents, with provision that the offspring should not differ to any large extent from one or other of the parents. The latter condition is ensured by the reduction in the number

of the chromosomes, for if this did not occur the offspring would either be of gigantic size, or would be developed abnormally in some directions. In the case of the eye, what is required is vision. The impulse of life, which from my point of view is the increasing influx, or finitization in matter, of Universal Mind, is to be regarded as effecting these ends directly. The complexity of the structures consists merely in the manner in which they appear to us when regarded from the point of view of building up similar structures. From the point of view of life, or spirit, the human eye involves no more complexity than the speck of pigment, sensitive to light, which constitutes the rudimentary eye of some foraminifera.

Bergson illustrates this by asking us to imagine the possibility of a human hand and arm passing partly into a solid mass of iron, leaving its imprint, and then being withdrawn. The imprint would have been formed by a single motion of the arm. Yet if we could see such an imprint produced by the action of an invisible arm, how hopeless would be the problem of accounting for it on mechanical principles, on the basis of the mutual interactions of the various particles of the metal, and excluding all consideration of the actual, though invisible, cause.

The subject of Professor Schäfer's address, referred to above (p. 193), is a study of the phenomena of living matter in so far as they are expressible in terms of visible movements. This limitation is definitely laid down in the opening paragraphs of the address, but although the question of the presence or absence of soul is expressly excluded[1], the professor does not appear to recognize that the restriction of the scope of his study to the phenomena of visible movement excludes not only the consideration of soul, of mind, of purpose, but also the whole domain of molecular physics, except in so far as it is approximately expressible in terms of the mechanical world-model.

[1] *Nature*, vol. 90, p. 8, Sept. 5, 1912.

As a study of the phenomena of life within these somewhat narrow limits, a study, moreover, by an extremely able physiologist of very wide experience, the address is of great interest and value to the critical reader. The uncritical reader, however, will certainly be confused, and probably misled, through failing to recognize the points at which Professor Schäfer unconsciously oversteps the boundaries which he has, explicitly or implicitly, laid down for himself. This confusion of thought has been abundantly manifested in the many sensational misinterpretations which have appeared in the newspapers.

The conclusion, and the only conclusion, to be derived from the address is that Professor Schäfer's wide experience as a physiologist tends to show the absolute continuity of all known mechanical laws throughout living, equally with non-living, matter. It therefore confirms, as far as it goes, the argument employed in chap. iv, and summarized elsewhere in the words:

"It will be unnecessary further to illustrate what all physiological research confirms—the absolute continuity of all known mechanical and molecular laws throughout living, equally with non-living, matter."[1]

So far Professor Schäfer is treading ground with which he is perfectly familiar, but when he proceeds further, and attempts to demonstrate the continuity of molecular as well as mechanical laws, it becomes evident that he has entered regions with which he is unfamiliar, for he weakens his case by omitting such evidence as is furnished by the experiments of J. C. Bose on response to electrical excitation in non-living and living matter, and by the numerous metallurgical analogues of organic phenomena: he weakens it further by pressing the analogies between crystals and colloids on the one hand, and living matter on the other, far beyond legitimate bounds.

[1] *Problem of the Universe*, p. 477.

When the case is adequately presented it is an overwhelmingly strong one in favour of the "absolute continuity of all known mechanical and molecular laws throughout living, equally with non-living matter." The conclusion that all changes in living matter "are brought about in conformity with the known laws of chemistry and physics", as stated by Professor Schäfer[1], is therefore fully justified by the evidence. But when he continues, "we may fairly conclude that all changes in living substance are brought about by ordinary chemical and physical forces", he is making, by implication, the further assertion that *no agency other than chemical and physical forces is concerned in changes in living substance.* And we have seen that this assertion, in support of which Professor Schäfer adduces no evidence, is demonstrably false in the case of both non-living and living matter. For the presence of purposive directivity, as a selective agency, and not as a force among other forces, has been demonstrated in the case both of living and non-living matter.

Professor Schäfer is quite justified in brushing aside, as unscientific, the *vitalism* which would represent purposive action as a force among other forces. I am not aware that such a view is advocated at the present day by any biologist of repute. But this may be due to ignorance on my part. What I can state is that all the biological advocates of *vitalism* with whose writings I have any acquaintance present purposive directivity as a selective agency, and I have proved that this exists, and need not abrogate any physical or chemical laws. Professor Schäfer does not attempt to refute their views—he does not even appear to be aware of them; and perhaps it is this neglect to make himself acquainted with recent work that has led more than one biological critic to describe his address as mid-Victorian in outlook.

[1] *Nature*, vol. 90, p. 9, Sept. 5, 1912.

CHAPTER VII

CHRISTIANITY THE CROWN AND COMPLETION OF RATIONAL THEISM

SUMMARY

Christianity is not merely a body of doctrine, but has for its centre and source the personality of Jesus. Jesus the ideal man —the complete manifestation of God in man. The essentially spiritual nature of His teaching for the benefit of the few who are chosen, combined with practical guidance for conduct, not merely for them but also for the many who are called. The Logos, like the concept of the Universal Mind, may be regarded as a bridge between God as the Absolute and man. The foreknowledge of God and the moral responsibility of man. Distinction between God as Absoluto-Infinite Being and the limited conception of God as other. Problems of the future state.

To regard Christianity as merely a body of doctrine, about God, and life, and conduct, is to mistake the husk of a nut for the whole fruit. The kernel is the personality of Jesus, which appeals every whit as strongly to those of this the twentieth century as to the disciples amongst whom He lived. He is recognized as presenting in His person, and in His life as recorded in the Synoptic Gospels, an ideal of man unattainable in practice and unsurpassable in conception, and this recognition is accorded even by minds obscured by the materialistic misconceptions of a stage of scientific thought which is now little more than a relic of the past. To some of us who have had to pass through this stage, the superhuman aspects of that personality have presented themselves as stumblingblocks, and even perhaps as almost insurmountable barriers. Yet while they may have seemed to obscure the light which it radiated they could not extinguish it. As John Stuart Mill tells us: "It is no use to say that

Christ as exhibited in the Gospels is not historical", for, as he most pertinently asks, "Who among His disciples or their proselytes was capable of inventing the sayings attributed to Jesus, or of imagining the life and character revealed in the Gospels?"

Uninstructed writers have claimed equality with Jesus for some of the great seers and teachers who preceded Him. Both the personality and the teaching of some of them attain, it is true, exceedingly high levels, and show how God has at all times and in all parts of the world been revealing Himself to mankind by prophets and teachers. An examination of the primary sources of information, however, shows that their personality was in all cases immeasurably inferior to that of Jesus; and that their teaching, although in some cases attaining the greatest heights of sublimity in the presentation of certain aspects of truth, could bear no comparison in respect of fullness and completeness with that of Jesus. Before proceeding to consider, first, the personality of Jesus, and secondly the essentials of His teaching, I must insist upon the absolute impossibility of attempting to eliminate the superhuman, or what is commonly known as the miraculous, element in the Gospel presentation. This is now becoming almost universally recognized by competent biblical critics, even those who were least predisposed to such a conclusion.

Born into a humble family, and working as an artisan until the age of thirty, the Gospels tell us little or nothing of the early life of Jesus with the exception of the noteworthy incident of His disputation with the learned Doctors of the Law in the temple at the age of twelve. When His parents find Him He answers His mother's gentle expostulation with: "How is it that ye sought Me? Wist ye not that I must be about My Father's business?" They do not understand Him in the least. At the age of thirty He takes up His mission. First comes the trial

and communing with God in the desert, in the course of which He utterly sets aside the temptation of presenting Himself to the people as the earthly King of their expectation, and comes forth in the consciousness of His infinitely greater mission as the Redeemer. He exercises superhuman powers, and although never emphasizing His personality, but rather keeping it in the background, He speaks with commanding and unhesitating authority. He collects His twelve disciples about Him by calling one and another from their work with the brief command "Follow Me", and they obey His call forthwith. He calls Himself Lord of the Sabbath. He says to a man, "Thy sins be forgiven thee." He says again, "Come unto Me, all ye that labour and are heavy laden, and I will give you rest." He prays even for His murderers. He says "My Father and I are one", and "He that has seen Me has seen the Father also". But He also says, "My Father is greater than I". His humility before God, and the absolute subjection of His will to God, is as strikingly characteristic as the authority with which He proclaims Him to men. He disclaims the title of "Good Master". During His agony in the garden of Gethsemane He prays to God that the cup may pass from Him, but always with complete self-surrender to God. In His last moments upon the Cross He, for an instant, feels Himself forsaken of God.

It is impossible for any of us fully to realize the nature of the consciousness of such a personality, but we may at least learn sufficient to grasp something of the significance of Jesus by considering how His personality, as presented in the Gospel narratives, appeals to the different grades of human consciousness, and testing the conclusion arrived at by a brief consideration of the nature of His teaching. He always appeals strongly to unspoiled human nature, as in the case of the child, and inspires it with love and reverence. The simple peasant and the untutored

savage, who may, like the child, have scarcely attained to the level of self-consciousness, are similarly attracted. These are still in the lowest stage of human consciousness, in which the body is the centre of the conscious life, but have not suppressed the intuitive aspiration, rudimentary though it may be, towards something higher than themselves. When the intellect is the centre of consciousness, and the body is recognized as not the self, but the servant of the mind, the love and reverence are intensified by the support of the understanding, and Jesus appears as an ideal, which, however, may be but a poor one if the intuitive aspiration has been seriously weakened by materialistic intellectual misconceptions. Those only appear to be repelled by the personality of Jesus who, having the mental capacity to make the intellect, more or less completely, the centre of conscious life, have, through selfishness, allowed the consciousness to become centred in the body, so that the mind, instead of controlling the body, has become its slave. The strongest appeal of all is in the case of those who, in universal consciousness, have recognized the true self, and made both mind and body the servants of the will. It is not, however, given to man, in the present stage of existence, to make the true self the permanent centre of consciousness. When it is realized, it is only by subduing body and mind, and then becoming as a little child in complete self-surrender to God, and involves losing touch for the time with the world in which man's duties lie. This condition has been obtained by many Eastern thinkers and seekers after God who had never heard of Jesus, but when the Gospel narratives in their simplicity are presented to such men they invariably recognize Him as a Holy One of God. Men who have attained the power of frequently raising the centre of consciousness into the true self, whether Eastern sages or Christian mystics, have always been noteworthy for love to all, readiness

to forgive insult or injury, insight into the minds of others, humility, and exceptional power over man and beast.

These are exactly the characteristics exhibited, to a supereminent degree, in the personality of Jesus. His power of reading human thoughts is frequently recorded in the Gospels.

My interpretation, therefore, of the presentation in the Gospels of the personality of Jesus is that His consciousness was permanently centred in the true Self, God, within His soul, without His being thereby withdrawn from action in the external world: that while the greatest saints and seers could control the intellect and the body by means of the will and make them their servants, but could only enter into universal consciousness by suppressing both, in Jesus the will, the intellect, and the body were all the obedient and ever ready servants of the true Self, God. This to my mind is the meaning of the statement that Jesus is the Christ, and what it would signify is that Jesus completely realized in Himself God's ideal of man, that He was the complete manifestation of God in man. In Him, as the words ascribed to St. Augustine say [1], *Factus est Deus Homo, ut Homo fieret Deus* [2], and so should be fulfilled the prayer of Jesus: "That they may all be one; as Thou, Father, art in Me, and I in Thee, that they also may be one in Us; that the world may believe that Thou hast sent Me. And the glory which Thou gavest Me I have given them; that they may be one, even as We are one."

When this is realized, many of the sayings of Jesus, which would otherwise be incomprehensible, become clear; as, for example, at the Last Supper, when Jesus, breaking the bread, says: "Take, eat; this is My body". And after breaking the bread,

[1] Appendicis Sermo, cxxviii, *In Natali Domini*, xii, inter opera S. Augustini.

[2] "God was made man in order that man should become God."

when Jesus distributed it to His disciples, and said, "Do this in remembrance of Me". This injunction was obeyed from the earliest days of the Christian Church, and the Lord's Supper became the central rite of Christian worship, being regarded as the supreme means of realizing the promised continuance of the Master's living presence in the midst of His followers. The reality of that presence rests upon the Master's authority as expressing the Will of God, which is the one and only source of all that exists. That which God wills to be present, thereby is present.

The disciples of Jesus recognized Him at a very early period as their highest conceivable ideal of man—the Jewish Messiah of their expectations. When, later on, in reply to the question of Jesus, "But whom say ye that I am?" Peter answered, "Thou art the Christ, the Son of the living God", Jesus says to him, "Blessed art thou, Simon Bar-jona: for flesh and blood hath not revealed it unto thee, but My Father which is in heaven. And I say also unto thee, that thou art Peter, and upon this rock I will build My church; and the gates of hell shall not prevail against it. And I will give unto thee the keys of the kingdom of heaven: and whatsoever thou shalt bind on earth shall be bound in heaven: and whatsoever thou shalt loose on earth shall be loosed in heaven." Peter had recognized Jesus as the Christ, not by external experience and reasoning, but by knowledge—by the true intuition which was the direct revelation of God to his soul. He was therefore on the way towards the complete recognition of God as the true Self within his own soul. Henceforth, then, what he should bind on earth should be bound in heaven; and what he should loose on earth should be loosed in heaven; that is to say, his external actions should no longer be those of the unenlightened consciousness, but of the illumined consciousness in union with the Eternal Spirit within him; and they would therefore stand

good not only before men, but in heaven, in the light of God's own presence.

That the expressions "kingdom of heaven", and "kingdom of God", when employed by Jesus, bore this internal spiritual meaning becomes perfectly clear on comparing the statements in which they occur. When His disciples asked Him why He spoke to the multitude in parables, His reply was: "Because it is given unto you to know the mysteries of the kingdom of heaven, but to them it is not given. For whosoever hath, to him shall be given, and he shall have more abundance: but whosoever hath not, from him shall be taken away even that he hath." It would be impossible more plainly to state the fact, which is one of universal experience, that when the intuitive aspiration after the higher than the recognized self, which is given to all mankind, is suppressed in place of being encouraged, it is eventually withdrawn. The obscuration and ultimate extinction of this initial intuition may arise either from the moral materialism which displaces duty as the ideal, and replaces it by such materialistic ideals as pleasure, wealth, or power. It may also arise from an intellectual obsession by the pseudo-philosophy of materialism. A real knowledge either of science or of philosophy is sufficient to remove such an obsession, and so enable the mind to know God through the intuition, by opening the way for the direct influx of universal into finite mind. Science and philosophy can give knowledge of the existence of God, and much knowledge about God. But there is an even more fundamental difference between knowing God and knowing about God than between knowing a finite person and knowing about that person. To know God is at least as easy to the child, or to the simplest peasant, as to the man of science or the philosopher, and Pasteur, the great French chemist, used to say that his scientific knowledge had led him, so far, to the faith of a Breton peasant, and that increase in this

knowledge might possibly lead him to the faith of a Breton peasant's wife. The attitude of childlike receptivity, by which alone the laying aside of sense and thought can be followed by entry into the kingdom of heaven, into the very presence and therefore direct apprehension of God, was distinctly set forth by Jesus in the words, "Verily I say unto you, except ye be converted, and become as little children, ye shall not enter into the kingdom of heaven. Whosoever therefore shall humble himself as this little child, the same is greatest in the kingdom of heaven." Immediately after this, Jesus proceeds to apply the spiritual teaching to external conduct, and adds, "whoso shall receive one such little child in My name receiveth Me."

The coming of the Son of man is described in terms which, apart from any other interpretation that may be given to them, are applicable in every detail to spiritual experiences repeatedly described by the Christian contemplatives and others as preceding the complete illumination expressed by realizing the kingdom of heaven. Jesus says: "Immediately after the tribulation of those days shall the sun be darkened, and the moon shall not give her light, and the stars shall fall from heaven, and the powers of the heavens shall be shaken". This is the first stage—the dark way of the soul. "And then shall appear the sign of the Son of man in heaven: and then shall all the tribes of the earth mourn", for the external senses and reflective thought upon their indications have been mastered and suppressed; "and they shall see the Son of man coming in the clouds of heaven with power and great glory." "For as the lightning cometh out of the east, and shineth even unto the west; so shall also the coming of the Son of man be." Then comes the last stage immediately preceding the full realization of the kingdom, the recognition within the soul of God in His infinity. "And he shall send His angels with a great sound of

a trumpet, and they shall gather together His elect from the four winds, from one end of heaven to the other." Jesus then confirms this interpretation of these sayings, for He continues: "Now learn a parable of the fig tree: when his branch is yet tender, and putteth forth leaves, ye know that summer is nigh: so likewise ye, when ye shall see all these things, know that it is near, even at the doors. Verily I say unto you, This generation shall not pass, till all these things be fulfilled."

His highest spiritual teaching, although not understood by His disciples at the time it was given, was preparing them for its complete understanding by realization in their own internal experience. And while giving this high spiritual instruction for the benefit of the few chosen to follow Him in the path of perfection, Jesus extended, not only His love, but His uplifting teaching, to the many who were not fitted completely to realize the kingdom of heaven before passing through the gates of death. As He said on one occasion, "Many are called, but few are chosen", but the many were not neglected for the sake of the few who were being trained by Him to become their leaders and teachers. Yet the two classes were clearly distinguished. The simple rule of Jesus whereby the many were ultimately to attain to eternal life was summed up in, *Love God and thy neighbour.* The rule of perfection was, *Sell all thou hast and give to the poor, and come and follow Me.*

The identity of the true self of man with the Divine Self had been recognized by the few in ancient India at least a thousand, and possibly several thousand, years before the time of Jesus; but although these few extended their love and kindness to the many, no serious attempt was made to teach them and lift them to higher levels of conduct. It was among the people of Israel that the teaching of conduct for the mass of the people attained its

highest level in pre-Christian times. But except in the earlier and most anthropomorphic forms, the Jewish conception of God presented Him mainly under the aspect of unapproachable majesty. He was regarded with fear rather than love, and as being far removed from the direct access of man, with whom He communicated through created spirit beings, the angels or messengers of God. It was the teaching, and, above all, the personality of Jesus which made it possible for the many who were called as well as the few who were chosen to realize towards God the perfect love that casteth out fear. The personality of Jesus therefore formed a bridge by which the many could be brought consciously within the sphere of God's love; and by which, moreover, both the few and the many could realize the consciousness of a personal reciprocal love between God, as other, and themselves. For in the self-realization of universal consciousness God is known by the merging of the finite self in the infinite self. God is not there realized as other, that is to say as distinct from the Self, and it is the sense of God as other that the soul of man craves for, and this craving is fully satisfied by the manifestation of God in Jesus, the Christ. The one is the Absoluto-Infinite, incomprehensible even when realized in consciousness. The other is within the finite time and space process; that is to say, in the world, and not, to our consciousness, in heaven.

God as other is the only sense in which He can be apprehended by the many, and the earlier and more primitive peoples formed the most varying concepts of Him, and found them sufficient. Generally, these concepts represented beings much more powerful than any man, and presenting both the virtues and the vices of a strong man greatly intensified. As a race developed in intelligence and became ever more capable of responding to the influx of higher ideals from the Eternal Infinite Mind, there usually emerged

the concept of a supreme being embodying all virtues, and from whom all vices were ultimately eliminated. The higher the concept formed of the supreme being, the greater became the distance which appeared to separate Him from man, and the interval was bridged over by intermediate spiritual beings emanating from, or created by, the supreme being.

To the thinker of ancient India Universal Mind was the primary manifestation of God which bridged the abyss between the invisible world—Absoluto-Infinite Being—and the visible, or phenomenal, world of existence. Ancient Greek philosophy never attained to that highest philosophical conception of Absoluto-Infinite Being, but the bridge which it built was practically the same—the Logos. In the English version of the fourth Gospel this is translated as the Word, but it means much more than merely the spoken word. It stands for the reason process issuing in the spoken word, or other form of expression, and it was shown in chap. v that this is the same thing as Universal Mind, being the very essence both of the human mind and of the external phenomenal world. Max Müller points out[1] that the term Logos was employed by Heraclitus in the sense of the Reason underlying the observed order of phenomena. Anaxagoras called it also Νοῦς, Mind, and so gave it a personal character. Neither attempted to relate it to the Deity. The Stoics made the relation one of identity, the Pantheistic conception; Philo, the Hellenic Jewish philosopher, employed it as a bridge between Jehovah and the visible world. Philo also called the Logos υἱὸς θεοῦ, the Son of God, and υἱὸς μονογενής, the unique Son, translated in the English version of the four Gospels as only begotten Son, but, as Max Müller remarks[2], the old Latin translations render it more correctly as *Filius unicus*. This is confirmed by

[1] *Psychological Religion*, Collected Works, vol. iv, p. 389.
[2] Ibid., p. 411.

Plato's use of the word μονογενής (*Timaeus* 31) in the sentence "Are we right in saying that there is one universe, or shall we rather say that there are many and infinite?"

St. Paul speaks of Jesus as the Mediator between God and man, which is the same idea expressed in a form suitable to the apprehension of the many. But great as was the influence of his preaching and writings in extending Christianity outside the Jewish people, I think Max Müller is right in his contention that the principal element in the development of Christianity into a world-religion was the recognition of Jesus as the incarnation of the Logos by Greek philosophers, some of whom were among the greatest of the early Fathers of the Church. As Max Müller writes[1]: "To the author of the [fourth] Gospel, Christ was not the Logos because He was Jesus of Nazareth, the son of Mary, but because He was believed to be the incarnate Word of God, in the true sense of the term. This may seem at first very strange, but it shows how sublime was the conception of the Son of God, the firstborn, the only one, in the minds of those who were the first to use it, and who did not hesitate to transfer it to Him in whom they believed that the Logos had become flesh, nay in whom there dwelt all the fullness of the Godhead bodily."

We see, then, that the widest and deepest human experience, internal and external, agree with the verdict of the intellect in establishing the authority of Jesus as the highest court of appeal in the spiritual realm, in that His personality appears as the supreme revelation of God to man, than which no higher is possible or even conceivable. I will therefore conclude with a brief consideration of two important problems upon which the teaching of Jesus throws additional light, or with respect to which further light appears to be thrown upon His teaching by the argument set forth

[1] Ibid., p. 404.

in earlier chapters. First, however, I must insist on the importance of distinguishing clearly between God, Absoluto-Infinite Being, and all manifestations of God within the time process. Manifestations are, from our finite view point, representations, or images; and our imaging of the infinite must necessarily be finite. The image must therefore involve elements of self-contradiction, for the simple reason that it is not, and cannot be, reality, but merely an aspect of reality, distorted by the limitations of our own finitude. A good example of such self-contradictions is the argument often urged by the unphilosophic thinker, that the moral responsibility of man is inconsistent with the foreknowledge of God. Here the term God is applied to the image of God, Absoluto-Infinite Being, as it presents itself to us within the time process. This is clearly indicated by the predication of foreknowledge, which can have no meaning except within the time process. There is no self-contradiction in the statement that all finite minds, and therefore the actions of all such minds, are completely determined in God. For in this case the term God stands for Absoluto-Infinite Being, which includes all finite minds within it. Whenever God is presented as other, as related to something other than Himself, to man, for example, the term God can signify a finite presentation only. The freedom of man's will precludes his being completely determined by anything entirely outside himself. This may appear more evident to some if expressed in terms of Universal Mind. The Universal Mind includes within itself, and therefore determines, all finite minds. But a finite human mind is not completely determined by the image of Universal Mind from which even that one finite mind has been abstracted.

We have seen that the same identical end can be attained in the time process by an indefinite choice of distinct paths to be traversed by the representative point which indicates the sequence of changes in the

material universe. Any undesirable deviations which would arise from the actions of any one finite mind, or groups of minds, may therefore be corrected with or without the aid of actions of other finite minds operating within the complete determination of Universal Mind itself. And this correction may be quite properly described as the overruling action of God, provided it be clearly understood that the term God here stands for the image of Universal Mind from which all human finite minds have been abstracted. There is no practical limit to such overruling action, because God in this sense is practically infinite in comparison with man. He is not, however, the true infinite, Absoluto-Infinite Being. Therefore in this sense of the term God, His overruling power, though practically unlimited, is not theoretically perfect, nor is His foresight. It is true that the moral responsibility of man precludes us from attributing perfect foresight or perfect control to God as the other. But this is not limiting God or asserting that God is finite. It is simply the recognition of the fact that when we think of God as existing in the finite scheme, that is to say whenever we think of Him as an object, we are necessarily dealing, not with the Absolute, but with a finite presentation of the Absolute.

We are now in a position to consider the two closely correlated problems: (1) What is the future to be anticipated for the seeker after God? (2) Will all human souls ultimately become seekers after God, or will some finally and deliberately turn away from Him; and if so, what is the future to be anticipated for the latter?

It was shown in chap. v, that all human ideals must, of logical necessity, find their fulfilment in the Absolute. It follows from this that the passage through the gates of what we call death cannot in general involve the exit of the self from the finite time process into the Absolute. And the ideal of

ultimate union of the seeker with God is certainly not one of those ideals which shall find its fulfilment mainly in the negation of its presentation as appearance. For it is neither a finite ideal nor one evolved from the finite, but proceeds from highest intuition, that of the true self which is God, as is completely confirmed by the teaching of Jesus. What, however, is the meaning of this union of the human personality with God, a union so complete that St. Augustine refers to it as man becoming God? Does it involve the complete absorption of the human in the Divine, and consequently the disappearance of the finite personality? We saw, in chap. v, that the emergence of human personality is explicable only as the action of the Divine Will, as Love, constituting the so-created personality a unique object of God's interest and love. It does not appear to be in accordance with reason that a personality, so constituted, should disappear in the very attainment of its complete perfection. For that would imply that the personality, a unique object to God's Love during the whole process of attaining perfection, must cease to be an object of this Love when the process is complete. This conclusion is fully confirmed by the teaching of Jesus. It will be sufficient to exemplify this by recalling the words from the prayer of Jesus previously quoted (p. 204), "that they may be one, even as We are one." The ultimate destiny of the disciples for which Jesus prays is that they should be as He then was; and His personality, when this prayer was uttered, was not merged in the Absolute. The conclusion, moreover, appears to me to be confirmed by the experience which I have called universal consciousness. Subject and object are here absolutely identified, and the Divine nature, as indicated by reason, is consciously recognized as the true Self, all consciousness of finite limitations having disappeared. And there is a consciousness of complete fullness of knowledge, which

might be called potential, or latent, omniscience. There is no knowledge of particulars, and its absence is not felt as a limitation. Yet this cannot possibly be the complete experience which reason shows must be in God. Here, then, reason establishes its supremacy by demonstrating the presence in God of what transcends even the highest intuition in which the very essence of God's nature is revealed to human consciousness.

The seeker after God is one who aspires to the best that he knows, who endeavours to follow good and reject evil; and experience shows that although such an one may often, through the weakness of human nature, choose a course which he knows is not the best, yet so long as there is an aspiration to follow the voice of conscience, and seek the better rather than the worse, his path of moral development will trend upwards, for God Himself reaches out to meet and aid even the feeblest of such aspirations. And it may be, and often is, feeble indeed. A cannibal savage, for example, may abstain from treacherously murdering and eating another member of his tribe, because his uninstructed conscience tells him that he *ought* not to do so, while he has not the slightest qualm of conscience in so treating a member of a hostile tribe. The latter action would certainly be an extremely evil one, but for him it would not constitute moral evil or sin. When, however, a man wilfully commits an act against which his conscience protests, he sins, he deliberately turns away from the good he knows, and chooses the evil. Every such action tends to lower his ideals, and persistence in this stifling of conscience will lead to his ideals, the ends which he sets before him, becoming ever more evil. We know from experience that a human soul is sometimes arrested, even after proceeding far upon such a downward path, and retraces its steps in untold pain and suffering. But each downward step makes

the next easier (*facilis descensus averni*) and increases the difficulty of return. The freedom of man's will, which makes him morally responsible, affords no philosophical basis for asserting that every soul will, sooner or later, be thus arrested, and compelled to retrace its steps. There is one conclusion that can be drawn philosophically and, as far as I can see, one only. If a soul were to continue its downward path until all good had been eliminated from its ideals it would thereby cease to have personal existence. For there would remain nothing to which the love of God could be extended, and it is God's love alone which constitutes the personality. Or, as we may also put it, if all good were eliminated from the soul's ideals there would remain no place for it in the Absolute. It would therefore cease to have any basis in reality, and without a basis in reality there can be no phenomenal existence. Jesus definitely affirms that there is one and only one unpardonable sin: "All sins shall be forgiven unto the sons of men, and blasphemies wherewithsoever they shall blaspheme; but he that shall blaspheme against the Holy Spirit hath not forgiveness throughout the age, but is in danger of age-long condemnation:[1] because they said, He hath an unclean spirit" (Mark iii. 28–30). The Jewish revilers of Jesus, in presence of the manifestation in healing beneficence of the Spirit of God which was his Self, stated that this Spirit was Evil personified. To them, therefore, absolute good presented itself as absolute evil, as the essence of all that is hateful; and thereby evil became their God, their

[1] The translation of this sentence in the Authorized Version is, "but he that shall blaspheme against the Holy Ghost hath *never* forgiveness, but is in danger of *eternal* damnation." The translation in the Authorized Version of the Greek words containing a specific reference to time, by the words *never* and *eternal*, would convey the idea, unwarranted by the original, that the absence of forgiveness and the danger of damnation (that is to say, condemnation) applied to the absolute timeless state.

end and aim and ideal. The teaching of Jesus is, therefore, that the only unpardonable sin is the deliberate rejection of God and the acceptation of evil as the ideal. The soul then progresses downwards instead of upwards, and is in danger of age-long condemnation.

Three different interpretations have been given to these words of Jesus by Christian theologians, corresponding to three distinct philosophical theories.

The theory most generally held by Christians is that the eternal condition of the soul is irrevocably determined at death, although further upward or downward progress, as the case may be, need not be excluded. Souls which pass through the gates of death as seekers after God will all finally attain to heaven, that is to say to complete union with God; while those who die impenitent, that is to say deliberately turning away from God, will be excluded from the complete union with God which constitutes heaven, and all souls so excluded are said to be doomed to hell. This, according to Monsignor Benson and other recognized authorities, is the doctrine of the Church of Rome. Monsignor Benson, for example, has stated that no soul will find itself amongst the rejected unless it has looked into the eyes of God and deliberately turned away. On the same occasion on which he made this statement he maintained that to such a soul heaven would be insupportable, and hell would therefore be the state to which it would turn of its own choice. This view involves the assumption that no human soul will be permitted to become wholly and entirely evil, for this, as we have seen, would involve the cessation of its existence. Moreover, even the souls doomed to hell cannot pass into a final eternal state until all the evil in them has been eliminated, for there is no place for evil in the Absolute. Although excluded from heaven, being incapable of rising to union with God, the final state

of even the most degraded soul would be one of the most complete satisfaction of which it was capable. From this point of view the relation of the final state of the soul in hell to the final state of the soul in heaven might be crudely represented by that of say an insect or a fish to that of the highest type of man, each in perfectly congenial conditions.

In the travesty of this conception, which has bulked so largely in popular theology of the most varied types, the eternal condition is regarded as simply an unending prolongation of the time process accompanied by unending purposeless torture.

A second theory, which is now held by large numbers of Christians, and has been held by many of the sages of India for thousands of years, is that the freedom of man's will, which, as we have seen, although sufficient for the moral order, is not and could not be complete, does not extend to permitting him to turn finally away from God. It is assumed that God will not allow one human soul finally to escape complete union with Himself, but that every downward step taken by a soul will ultimately have to be retraced in pain and suffering.

The remaining theory is, that the freedom of the human will is left untrammelled to the extent of allowing the soul to continue in wilful rebellion against God until, falling from stage to stage, it ultimately loses every trace of good, and thereby ceases to exist.

If there be discarnate spirits, not necessarily of human origin, which are thus proceeding on the downward path towards ultimate destruction, their existence might possibly account, in ways as yet unfathomed by man, for many of the discords, and the apparently unnecessary and purposeless suffering of men and animals, which seem to be such conspicuous features in the scheme of nature of which man forms a part.

CHAPTER VIII

THE FUNDAMENTAL PRINCIPLES OF SOCIAL PROGRESS

SUMMARY

Necessity, for individual self-realization, of life in a community.

Comparison of animal and human communities.

Man has an inherent right, and duty, to freedom for self-realization.

Owing to human weakness and selfishness, regulative rules and laws become necessary for the maintenance of harmony; that is to say, justice, positive and negative.

The personality of individuals is the source and motive power of social progress.

If society were non-ethical, justice would be negative only, but being ethical, justice must be positive also; the latter is, however, limited by the condition that the freedom of self-realization must not be impaired.

The three methods by which a community fulfils its duties are Sociality, Voluntary Organization, and Legislation. Voluntary organizations may need legislative regulation to prevent their becoming hurtful, instead of beneficial, to the community.

Since the universe is an ordered system, expressing eternal purpose, therefore every living organism, in common with every part of the material universe, has its law of being; and its object, or purpose, is the fulfilment of this law. The non-living portions are constrained to fulfil their purpose entirely by external action of a character which may be approximately represented by a mechanical or quasi-mechanical scheme, or model. But even in the most lowly types of living beings we have seen that the directivity everywhere immanent in the universe is exhibited partly in and through the organism itself; and that after the appearance of consciousness an important part is played by pain, which is nature's warning to

the organism that it is deviating from its law of being; that is to say, that it is failing adequately to fulfil its purpose.

In the case of man the rise of consciousness into self-consciousness, or in other words the emergence of reason, enables him consciously to seek and endeavour to fulfil the law of his being, self-realization, the full and free development of his personality. The erection of any barrier or impediment to such self-realization is profoundly immoral, for the full and free development of his personality is the one and only inherent right of man, rooted in the eternal purpose of the universe; that is to say, deriving its origin from God Himself.

It is obvious that a single human being, man or woman, could not attain, in solitude, to any adequate self-realization, could not develop to a stage much higher than that of an exceptionally cunning animal. The highest possible self-realization even of complete man, male and female, if alone except for the companionship of their offspring during their childhood only, would be very inadequate. Man therefore feels impelled to enter a community in order to realize himself. The original impulse to form communities was, in the case of primitive man, partly external, arising from the necessity for co-operation in protection against external harm from other men or from fierce beasts. Far more powerful, however, was the internal impulse arising from the development of the altruistic principle, which, making its appearance at a very early period in the evolution of living beings in the form of care for offspring, developed in man into sympathy. As life progresses from lower to higher forms, it is invariably found that the individualistic and altruistic principles both continue their growth, but the rate of growth of the latter tends to increase more rapidly than that of the former. This holds good throughout the whole course of the line of

development of increasing instinct, and throughout the line of development of increasing intelligence up to the emergence of reason.[1] The ant and the honey bee are examples of the highest forms of development in the direction of instinct. In communities of these creatures the development of the altruistic principle has dwarfed that of the individualistic principle into relative insignificance. The welfare of the individual has become of no account except in so far as it is necessary to the welfare of the community. When the individual bee or ant is no longer of service to the community it is destroyed with no more compunction than we exhibit in discarding superfluous cells from the organism which we call our body; as, for example, when we cut our hair or trim our nails. In the case of the human organism we know that the consciousness is exhibited by the organism as a whole, and we have no grounds for attributing anything of the nature of consciousness to the individual cells which collectively constitute the organism. In the case of a community of ants or honey bees, on the contrary, it is the individual that is conscious, and I am not aware that the existence of a collective consciousness of the whole community has ever been suggested. Yet a hive of bees certainly acts as a whole, exactly as if it possessed such a collective consciousness[2], and may therefore, for most practical purposes, be treated as an organism.

The organization of a human community, on the other hand, can never develop into an organism, for we have seen that man's law of being is the development of an individuality, which is little more than segmentation, into personality, which is a centre of spontaneous activity. A human community must therefore be organized in such manner as to aid, not to impede, the development of personality. The

[1] See chap. vi, p. 195.
[2] See Maeterlinck on *The Bee*.

community must therefore be one which exists for the benefit of its constituent units; and this is the direct opposite of an organism. A community so organized that man could enter it only by the surrender of his will would be constituted on an essentially immoral basis, for it would involve the suppression, instead of the development, of his personality. The life of such a community could not therefore be one of progress, but must of necessity be one of regress, a descent from the human to the animal level, effected by the gradual replacement of intelligence by instinct. Man's right to the free development of his personality is one of which he cannot be deprived by any earthly power, for it originates in God Himself, the one and only source of all personality. Man, therefore, has an inherent right to the free development of all the activities, moral, mental, and industrial, in which his personality finds expression.

Since the world is essentially the expression of eternal purpose, the true following out of the law of self-realization by any one member of a community cannot conflict with the self-realization of its other members. Such conflicts as do actually arise in all human communities can have no other origin than weakness, including ignorance; and selfishness, that is to say conscious ill-will. If it were possible completely to eliminate both weakness and selfishness, the growth of sympathy and mutual love would lead to perfect co-operation in absolutely unrestricted freedom. Weakness and selfishness are, however, exhibited in some degree by all, and exemplify the eternal truth of the fall of man, his tendency to deviate from the upward path of self-realization, in and through his fellows, in accordance with the true law of his being. In order to provide a safeguard against the effects of weakness, rules and regulations have been formulated in all human communities, even the most primitive ones. These rules have usually originated

in customs, some reasonable, others very much the reverse, to which men felt their way more or less blindly. From these rules have arisen the various forms of voluntary organization. Voluntary rules and organizations, however, although sufficing as guides to mere weakness and ignorance, afforded no protection against conscious selfishness or ill-will. To effect this it was necessary to enforce the rules by sanctions; that is to say, by the infliction of penalties for their infringement. The voluntary rules thereby became transformed into laws, for a law is simply a rule of conduct enforced under penalty. We see, therefore, that the primary purpose of law is to maintain the utmost attainable harmony in the community.

In an ideally perfect community, every member of it would pursue undeviatingly the path of self-realization in and through his fellows. In such a community the limitations imposed upon each member by the regulative conditions would always aid, and never impede, his course of self-realization. The state of such a community would be one of perfect harmony; and in such a community there would be no injustice, no infringement of the right of each member to the full and free development of his personality which is his one inherent and inalienable right. We see therefore that justice is simply harmony, and this was Plato's definition of justice. The primary purpose of law may therefore be defined as the maintenance of justice as a guarantee of individual freedom.

In the formulation of laws, as in all social progress, the personality of individuals is always in evidence. The aristocracy of mind is invariably confined to a few. From it all great ideas derive their origin, although the community, by submitting itself to the guidance of the few who are both wise and kind, as Ruskin expressed it, may ultimately assimilate and benefit by them. It is this aristocracy of mind which is the source and motive power of all social progress;

and the determining factors of progress are the ideas presented by the few to the many, and the assimilative capacity of the many.

These are the factors which determine the general will of the community, and it is this general will which, at any given time, may be taken as representing the closest attainable approximation to the law of being of the community, and therefore as the source of laws. For their promulgation a lawgiver or sovereign is required who, as interpreting and formulating the general will, constitutes the origin of the laws. The general will may best be interpreted, according to the nature of the community, by a single upright governor ruling, not for his own benefit, but for the general good; by an aristocratic or oligarchic council; by an elected representative body; or by a combination of two of these elements or of all three. Legislation for the benefit of the sovereign, or of any special class, must inevitably lead to social disorder, which may end in disruption. It should be noted that this is equally applicable in the case of a democratic majority and of an absolute sovereign.

The primary form of justice is the protection of the freedom of each individual member of the community from the encroachments of other individuals. It includes the protection of the whole community from external aggression, and the protection of the individual citizen from interference on the part of other citizens, as long as he conforms to the laws by which the community is regulated. Plato called this *negative justice*, and a State in which the administration of justice is negative only has been compared to a machine tended by a policeman with authority behind him. The further development of justice, designed not merely to prevent interference with the self-realization of the individual but to aid his self-realization, was called by Plato *positive justice*. The first step taken in the direction of positive justice has

invariably consisted in facilitating co-operation between individuals, by giving legislative sanction to contracts freely undertaken between responsible persons, always provided that the contracts so validated involve nothing hurtful to the community.

If a human society were a non-ethical organization there would be no logical place for positive justice, nor would there be any tendency for justice to extend beyond its purely negative limitations in the name of philanthropy or benevolence. The only question that could possibly arise would be, as Dr. Laurie has expressed it [1], "What is the *least* I can do for others in order to have free scope for my own desires?" Every human society must, however, be essentially an ethical organization, for the community, and therefore its governing executive, the State, is, like the individual and the universe in which he finds himself, instinct with purpose. The State, therefore, contains within itself from the first the ideal of harmony or justice. The obligation of the State to assist those unable, through the pressure of adverse circumstances, to realize themselves must, consequently, be governed by the same general considerations that determine the corresponding duty of the individual. The State is merely man writ large, so that it may be regarded as simply a greater and more powerful man than any single member of the community. The action permissible to the State is, however, subject to a limitation which is not applicable to the individual. A man may, and if he would follow the path of Christian perfection, must, be unjust to himself, must sacrifice himself for his fellows. He must not, however, do an injustice to one of his fellows in order to confer a benefit upon another, or others. Now the only way in which the State can sacrifice itself, that is to say, do an injustice to itself, is by treating some of its citizens unjustly in

[1] *Ethics of Reason*, p. 182.

order to benefit others. And this is no more permissible to the State than to the individual.

The recognition of these elementary facts is the essential preliminary to the discovery of the fundamental principles of what may be called State design. But it must be borne in mind that although a knowledge of these principles is essential to the construction of a stable and progressive scheme of government, it is by no means sufficient. It must be supplemented by knowledge of the lessons of the past, and of the requirements of the present. The design of a State is a problem of far greater complexity and difficulty than that of the most complicated machine or of the most elaborate engineering structure. Yet every engineer knows that he would be courting failure if he were to attempt to design such a machine or structure without previous experience of work of a more or less similar character, however complete his knowledge of the principles of engineering design. General principles must never be regarded as substitutes for experience. They form, however, guides of the utmost value, for by their aid the engineer and the statesmen are alike enabled to utilize to the fullest extent the experience of the past by adapting it to existing conditions.

Self-realization is the right and the duty of each one of us, and from this fundamental point of view right and duty are but two aspects of a single idea, and their divorce and erection into distinct concepts involves the gross perversion of each. For our feudal forefathers privilege and responsibility were recognized as inseparable. In society of the present day this principle has become lamentably obscured, its obscuration being one of the many bitter fruits of the materialistic pseudo-philosophy of the eighteenth century. This obscuration is the root of most of the labour-unrest which is troubling the greater part of the civilized world. We saw, moreover, in chap. v,

that the principal means of self-realization is found in helping our fellows to realize themselves. It is therefore the duty, and the right, of each one of us to aid his fellows to the fullest extent of his capacity —to love his neighbour as himself. This being the duty of every member of the community, it must also be the duty of the whole community, so that as soon as the public conscience is awakened to the existence of unjust relations among men the whole community is under obligation to go as far in alleviating the conditions of life as the public conscience will allow.

Now it is illegitimate for the individual, and therefore also for the community, to do for any man what that man is capable, with due effort, of doing for himself, for this would tend to enervate him, and would therefore be injurious instead of beneficial. Such action, if carried out generally, would therefore be harmful to the ethical development of the community. The individual, and therefore also the community, is, however, not only justified in providing opportunities and guidance for the individual citizens where requisite, but is under obligation to do this as completely as possible.

It would be a fatal error to assume that the functions of the State are coextensive with the duties of the community. We have seen that in a community of ideally perfect individuals complete harmony or justice would be attained by free social co-operation, or sociality, as I have called it elsewhere.[1] Voluntary organization is rendered necessary only by the weakness and ignorance of individuals, while the transformation of voluntary organization into legislation is necessitated by ill-will, or selfishness. There are, therefore, three methods by which a community may carry out its duties:

[1] See *The Superstition called Socialism*, p. 78.

1. Free Social Co-operation, or Sociality.
2. Voluntary Organization.
3. Legislation.

These methods are very closely related to one another, but there is a distinct step from each one to the next, and it is in each case a step downward, marked by an increased restriction in freedom. Sociality is therefore always to be preferred to Voluntary Organization, and only when these two fail should Legislation be resorted to.

A very good example of the applicability of these several activities is found in the case of the absolutely helpless. Destitute orphans of tender age cannot immediately be helped to realize themselves. They must at first simply be provided for, and no one will question that the best method is that of adoption into families, with the minimum of State-regulated supervision and inspection necessary to prevent abuses. The destitute sick, imbeciles, and lunatics, require skilled treatment which could not be given to them in families, so that Sociality will not here meet the requirements of the case, and these classes have to be treated in hospitals. These institutions are frequently under municipal or State control, but few would contend that hospitals under the control of voluntary organizations would not be preferable if only they received sufficient support. Finally, we come to the class of confirmed wont-works and habitual criminals, who at present are allowed to become parasites on society, and largely to increase the difficulty of the problem of effectually aiding the deserving poor. Here voluntary institutions would be inapplicable, because the segregation of these classes, and setting them to work under the requisite discipline, involves compulsion, which can be applied only by the authority of the State. The segregation of the unfit, and their subjection to kindly and sympathetic, but at the same time masterful, discipline must form an

essential factor in any scheme of social progress and reform as one of the fundamental conditions of permanent success.

The elimination of the unfit and the provision of facilities for the self-realization of the weaker members of the community by protecting them against the aggression of the stronger members do not, however, by any means represent the whole duties of the community. It is of even more importance to the progress of the community as a whole that adequate facilities should exist for the full and free development of the stronger members and for the encouragement of the exceptional ability upon which the continued progress of the community must mainly depend. With this end in view the legislation and administration of the State, the executive of the community, must not only encourage the development and utilization of individual ability; it must also facilitate the formation of the strong voluntary organizations which promote the well-being and progress of the community, both by providing media for the development of exceptional ability and by fulfilling functions which would otherwise largely add to the burdens of the State.

Noteworthy examples of such organizations are afforded by the Trusts and Trade Unions of the present day. Both have thoroughly legitimate and extremely important fields of activity. The legitimate functions of the Trusts are the extension and improvement of the process of production and distribution, including the lessening of the cost of the product to the consumer, and collective negotiation with labour represented by the Trade Unions. The legitimate functions of the Trade Unions are to improve the conditions of life of the workmen by encouraging thrift, promoting their more effective education, building up character, and by means of collective negotiation with the employers and Trusts,

enabling them to obtain their due share of the total product of the industry in which they are engaged. Both Trusts and Trade Unions may and do endeavour to utilize their power by unjust and oppressive action, and it will therefore become necessary, as their power increases, to subject them to such State regulation as may be necessary to prevent action injurious to the community as a whole.

Whenever possible, voluntary organizations, subject to such legislative restrictions and State supervision as may be requisite to prevent harmful action on their part, and no more than this, are to be preferred to the creation of State Departments. In the first place, the work of the voluntary organizations is more progressive and in every way more efficient, because they allow of much greater freedom for the action of individual initiative. They are to be preferred, moreover, for the far more fundamental reason that every unnecessary extension of the sphere of action of the State, the centralized executive power of the community, increases unnecessarily the restrictions upon the individual liberty of the members of the community.

CHAPTER IX

METHODS OF SOCIAL REGRESS PROPOUNDED AS METHODS OF PROGRESS

SUMMARY

Secularism, and the reason for its hostility to religion. The consequences which would follow from a loss of all religious ideals.

Anarchism, its creed and its origin.

Christian Socialism and real Socialism. State Socialism, Communal Anarchism, and Nebulous Socialism. Socialism, involving the negation of personality, involves the negation of Christianity.

Syndicalism, its objective, and procedure of the general strike. The so-called philosophy of Syndicalism.

SECULARISM

THE aim of Secularism is the elimination of religious ideals and aspirations from the life of the community. Now we have seen that the essence of religion is aspiration towards something greater and higher than humanity. The aim of the secularist, therefore, is to deprive the community of every ideal higher and greater than itself. That such a policy is essentially one of regress has been acknowledged even by the ablest of the materialists, who believed that all such ideals were mere illusions destined ultimately to disappear. Dr. Henry Maudsley, who was, without question, one of the ablest scientific materialists of the last century, expressed himself as follows[1]:

"And here one cannot help being somewhat disturbed by the question: To what larger whole than itself shall humanity have regard? Will it discover for

[1] *Body and Will*, pp. 193, 323.

itself a saving ideal in aspirations to do the service of a cosmical whole? Or will it be left finally without an ideal? When it comes to pass that humanity, fully constituted, is sensible of no vital relations to anything higher and larger than itself, and longs for no fuller life to attain a higher life outside itself, it will then have reached the term of its development and the beginning of the end. The impulse of evolution will have been exhausted in it."

"What an awful contemplation, that of the human race bereft of evolutional energy, disillusioned, without enthusiasm, without hope, without aspiration, without an ideal." It was, indeed, truly said by Voltaire that "if there were no God it would be necessary to invent one", for in any community which has entirely lost the belief in God, or in Gods, progress must inevitably cease and regress begin.

It is a most noteworthy fact that all the systems of social regress with which we shall have to deal in this chapter, as being propounded by cranks, and by interested individuals who are not troubled by any scruples when they see an opportunity of personal benefit, are characterized by a deep-seated hostility to religion as far as their more intelligent advocates are concerned. The cause of this is not far to seek. The ideals engendered in the pursuit of science, literature, and art have saved from the otherwise inevitable regress towards the level of the beast many of their votaries who had lost the primary intuition of a Higher Power which is common to all mankind. But these are the pursuits of the few, while religion makes its appeal to all from the king upon his throne to the peasant in his cottage. Religion is therefore the one enemy to be feared by those foes of humanity who preach these systems of regress as panaceas for all the ills of society.

Experience shows that when Secularism has succeeded in establishing itself in the seat of government

its hostility does not long remain passive, but finds expression in active oppression, and in both open and underhanded attempts to suppress corporate and individual liberty. In France it has, in recent years, taken the form of introducing into the elementary schools such crude blasphemies and puerile imbecilities as are to be found in *Le Petit Catéchisme du Libre-Penseur*[1], in the suppression of teaching communities, and even of the nursing sisterhoods which are beloved of rich and poor alike in all lands, and finally, in the petty but effective persecution of officials, from military officers to porters on the government railways, who were known as practising their religion or having their children instructed in it. Fortunately for the future of our friends and allies, the French nation, the inevitable reaction is now making itself felt, and will gather force as it becomes more and more fully recognized that Materialism as a system of thought is dead and has now to be dislodged only from the purlieus of incapacity and ignorance. Portugal affords a still more striking example, for in that unfortunate country the government has fallen for a time into the hands of the fanatically ignorant devotees to whom the pseudo-philosophy of Materialism has descended after being discarded by all instructed minds. Here we find the practice of religion penalized by the infliction of savage barbarities which may serve to warn us of what is to be anticipated if we permit the structure of society to be overthrown by the mob-orators of anarchy and sedition.

Anarchism

The creed of Anarchism finds expression in the motto of the Russian anarchist Bakunin, *Neither God nor Master*. The amiable so-called philosophical anarchist denies that human communities have received any benefit from the formulation of rules and

[1] See *The Superstition called Socialism*, p. 150.

the promulgation of laws for their regulation. He maintains, on the contrary, that if all authority could be eliminated from the world it would straightway be transformed into an earthly paradise in which all mankind would dwell together in harmony and brotherly love. Other anarchists are not so altruistic in their ideals, but simply express their desire for a society in which every man should be a law unto himself. At the International Anarchist Congress at Amsterdam in 1907, the delegate Croiset expressed the fundamental principle of Anarchism in the words "Myself first, and then the rest."[1]

Socialism

The term Socialism appears to have been first employed about the year 1836, and rapidly came into use as a generic name for the multitudinous schemes of social organization which had been appearing in France since the beginning of the century, as de Tocqueville observed, "almost every morning like mushrooms that had grown up during the night". The majority of these had for their sole foundation the foolish aphorism, Liberty, Equality, and Fraternity. It is a foolish aphorism for the simple and sufficient reason that it embodies a self-contradiction, for men are not naturally equal; so that equality in a human community could be brought about only by the imposition of external restraint, which would involve the negation of liberty and of those salient aspects of fraternity, the care of the strong for the weak and the trustful reliance of the weak upon the strong.

It is not, therefore, surprising to find that the term Socialism has been employed in many and often mutually inconsistent senses; and that this vagueness should be reflected in the definitions of the word

[1] See also *The Superstition called Socialism*, pp. 101–7.

which are to be found in different standard dictionaries. Frederick Denison Maurice and Charles Kingsley called themselves Christian Socialists, using the term Christian Socialism with the signification of the application of Christian principles to social life, and the conclusions arrived at in chap. viii show that the basis of social life afforded by practical Christianity is absolutely identical with the basis arrived at independently from reason and experience. Bishop Westcott, who called himself a Christian Socialist in this sense, in a paper read at the Church Congress at Hull in 1890, stated that "The aim of Socialism is the fulfilment of service; the aim of Individualism is the attainment of some personal advantage, riches, or place, or fame. Socialism seeks such an organization of life as shall secure for every one the most complete development of his powers. Individualism seeks primarily the satisfaction of the particular wants of each one in the hope that the pursuit of private interest will in the end secure public welfare." Here, again, the term Socialism is employed as signifying the Christian basis of social life, while Individualism is taken as standing for the unrestricted selfishness of the Manchester School of Economics.

The term State Socialism has been employed in exactly the same sense in applying it to Prince Bismarck's policy of German social reform. So long ago as June 15, 1847, when Bismarck was an unknown provincial deputy, he declared to the Prussian United Diet:

"I am of opinion that the idea of the Christian State is as old as the *ci-devant* Holy Roman Empire, as old as all the European States, that it is the soil in which these States have taken root, and that a State, if it would have an assured permanence, if it would only justify its existence when it is disputed, must stand on a religious foundation. . . . I believe I am right in calling that State a Christian State

which seeks to realize the teachings of Christianity. That our State has not succeeded in doing this in all respects was shown yesterday by the Deputy Baron von Vincke in a parallel, more ingenious than agreeable to my religious feelings, between the truths of the Gospel and the paragraphs of common law."[1]

In 1881, when justifying his social measures before the Reichstag, he said: "If a name be desired for our endeavours which I could willingly accept, it is practical Christianity, but *sans phrase*."

Again, in 1882, he said:

"I do not comprehend with what right we acknowledge the commands of Christianity as binding upon our private dealings, and yet in the most important sphere of our duty—participation in the legislation of a country having a population of forty-five million people—push them into the background and say, here we need not trouble. For my part I confess openly that my belief in the consequence of our revealed religion, in the form of moral law, is sufficient for me, and certainly for the position taken up on this question by the emperor, and that the question of the Christian or non-Christian State has nothing to do with the matter. I, the minister of the State, am a Christian, and as such I am determined to act as I believe I am justified before God."[2]

A. Wagner, the leading representative of this so-called State Socialism in Germany, observes that "The relation of man to man should again be asserted in the economic relationships between different persons."[3] Schmoller, another of its exponents, states that State Socialism aims at "the re-establishment of a friendly relationship between social classes, the removal or modification of injustice, a nearer approach to the principle of distributive justice, with the

[1] *Bismarck and State Socialism*, by W. H. Dawson, p. 23.
[2] Ibid., p. 24.
[3] *Rede über die sociale Frage*, p. 8.

introduction of a social legislation which promotes progress and guarantees the moral and material elevation of the lower and middle classes."[1]

That this is not Socialism, as the term is now employed, is admitted at the present time even by those who call themselves Christian Socialists, the members of the Church Socialist League, for example. The Rev. and Hon. J. G. Adderley, one of the most prominent leaders of this body, definitely states that neither Maurice, Kingsley, nor Westcott was a Socialist.[2] The belief that these principles represent what is meant by Socialism has been and is, nevertheless, responsible for inducing many well-meaning Christian people to call themselves Socialists and to support real Socialists by their money and votes.

The term Socialism is also frequently applied, and altogether improperly, to the Municipal supply of drainage, water, gas, and electricity, under the name of Municipal Socialism, or sometimes Gas and Water Socialism. I have shown elsewhere the conditions and limitations under which such public operation of industries is legitimate.[3] Socialists are always extremely anxious to extend this public operation beyond its legitimate limits, in the expectation that it will tend to the realization of their ideals; and dishonest socialist advocates, when addressing themselves to the very ignorant, often endeavour to persuade them that the success of legitimate municipal enterprises is an indication of the desirability and feasibility of their ideals.

Professor Flint defines Socialism as "any theory of social organization which sacrifices the legitimate liberties of individuals to the will or interests of the community".[4] This is a perfectly true statement, but

[1] *Über einige Grundfragen*, p. 92.
[2] *The Parson in Socialism*, pp. 158, 182.
[3] *The Superstition called Socialism*, pp. 238 et seqq.
[4] *Socialism*, p. 14.

it has the disadvantage that the majority of Socialists would refuse to admit it. I prefer therefore to adopt a definition which they will admit, and then to show that it necessarily involves the consequences indicated by Professor Flint.

All the various Socialist parties, wherever Socialism exists, are agreed in defining its essential aim as being *the socialization of the means of production, distribution, and exchange*; that is to say, the abolition of private ownership of land and other forms of capital, and the carrying on of all industry and commerce by the community as a whole and not by individuals. Socialism is therefore based upon an aphorism, and involves a return to the communal holding of land and capital which was almost universal during the earlier stages of man's existence, when tribes had not yet developed into nations. Capital in those days was largely represented by the tribal flocks and herds. The preaching of the abolition of private property as a panacea for the ills of society is by no means a novelty, for Aristotle ridiculed it in his *Politics* a couple of centuries before the Christian era.

In the volume previously referred to I have dealt with the vain attempts which have been made to establish the basic aphorism of Socialism upon a rational basis, and all such attempts must necessarily be vain, for it is easily seen that the aphorism is essentially irrational, in that its complete realization would necessarily involve the regress of man from reason to instinct, a descent to the level of the beast.

Traces of the early tribal communism are still to be discovered in most parts of the world, and these are most marked in the case of the more backward nations. History, which is the record of experience, supplies the explanation. The progress of a human community does not resemble the growth of a meadow. The grass of a meadow presents an approximately level surface in all stages of its growth. In a human

community, on the other hand, we observe the greatest variation in mental and moral stature, and here and there individuals are found who far overtop their fellows. These are the natural leaders, and the progress of the community is most rapid when it recognizes their superior wisdom and submits itself to their guidance. This exceptional development of personality is always most marked in communities in which there are the least restrictions upon individual freedom, and leaders of highly developed personality are always the first to rebel against unnecessary restrictions as impediments to the progress of the community.

Now the communal holding of land, and of flocks and herds, is natural in a patriarchal family governed by its head. As the family expanded into a tribe, however, the maintenance of the communal system necessarily led to the development of rules and regulations for the management of the tribal property and the distribution of its proceeds amongst the families of the tribe. As the tribe increased in size these rules necessarily became more elaborate in character, and also more rigid in their application, and it was found increasingly necessary to enforce them by the infliction of more or less graded systems of penalties, thus transforming them into laws. This continued until there arose a leader with sufficient wisdom to recognize the inadequacy of the communal system, and sufficient strength of character to sweep it aside, with the whole mass of laws and regulations which it involved. When this had been effected, and the property allocated to the various families of the tribe, the progress of the tribe was accelerated and its strength and prosperity were increased. Such a tribe was therefore almost certain to be victorious in conflicts with the less progressive tribes which still retained the communal system, and so the system gradually disappeared, the stronger races abandoning it under

the guidance of their own leaders, and the weaker races because they were conquered by the stronger and more individualistic.

The only example of the existence of Socialism on a national scale within historical times is the system under which the peasantry of Peru lived before the Spanish conquest. They appear to have been quite contented with the firm but kindly rule of the Incas and the nobles, under which the peasants were treated like children and their lives regulated upon a socialistic basis. That such a system was entirely destructive of all individuality and strength of character was shown, however, by the facility with which the nation was enslaved by a mere handful of Spaniards.[1]

A system of complete community of goods was tried by the first Christian Church founded at Jerusalem, and its failure within a few years after its inception was demonstrated by the fact that St. Paul had to appeal on its behalf to other early Christian Churches for charitable contributions. The tendency of extreme religious fervour to regulate the material concerns of life upon a communistic basis is a very noteworthy fact, and it is amongst religious communities only that any societies have been constituted on such a basis with permanent success. And the instances of success, although including the votaries of faiths differing as widely as Buddhism and Christianity, are to be found only amongst the religious orders, from which all family life is excluded, and whose ideals relegate all material conditions to a position of little or no account, except in so far as they are absolutely necessary for the maintenance of the lives of their members in such manner as to enable them efficiently to devote themselves to the realization of their ideals. All available experience, therefore, leads to the conclusion that the substitution of community of goods for private property will prove satis-

[1] See *The Superstition called Socialism*, p. 332.

factory as a basis only for such societies in which material things are regarded as hindrances, and not for societies in which they form objects of desire. In societies of the latter type, which includes all human communities with which statesmanship is concerned, even the partial abolition of private property demanded by Socialism would necessitate the imposition of a regulative system which would act as an impediment to the development of personality, and any such would therefore be swept away by its development. In societies of the former type, on the other hand, the complete abolition of private property is found to be the best method available for liberating its members from the bondage of material considerations and leaving them free to pursue the path of spiritual self-realization.

Even a religious community, consisting exclusively of the most saintly individuals, would have to submit itself to a strict rule under the direction of a ruling head. For in no other way could the necessary share of each in the work essential to the continued existence of a self-supporting community be apportioned. It would be a willing obedience and not one imposed by external constraint. It would be the result of self-control and not of control from outside, and would therefore promote, instead of impeding, the development of personality. The material requirements of such a community would obviously be reduced to the mere essentials of the simplest life. It is in communities of this character that community of goods has proved a successful policy, but even in the best of them perfect harmony has never been attained. To attain a perfect harmony it would be necessary for all the actions of the community to be such as would result from a true collective consciousness expressing itself in and through each and all. But this would mean that every member of the community must attain to the level of the life lived by Jesus Christ;

that every member should attain to the universal consciousness, not merely at intervals, but should live their lives at that level and direct every action by a consciousness with its centre at this level, and at the same time capable of expressing itself in the ordinary actions of everyday life. That is to say, that every member of the community would have to attain to the full stature of Jesus Christ, a level to which no human being other than He has ever attained within our experience.

There could be no possible objection to the attempt to approximate towards such ideal conditions, or to the preaching of such an ideal, for the one and only way of approach towards it would be the path of self-realization by unremitting and strenuous effort and self-control. It would not, however, be applicable to a community of men and women, even with the highest ideals, living a family life. For children born into such a community would not of necessity come to share its ideal when they attained to years of discretion. Discord would therefore gradually be introduced, and could be eliminated only by the imposition upon recalcitrants of external control, which would be the negation of the ideal, and lead to the disintegration of the community.

Let us now attempt to place ourselves, for the moment, in the attitude of an intelligent enthusiast who is prepared to adopt as an end in itself the transformation of a modern civilized community into a socialistic one, accepting all the consequences involved, and directing his actions by reasoned conclusions derived from the basis of past experience. The first step requisite would obviously be the conversion to his views of a section of the community sufficiently powerful to be able to impose its will upon the remainder. It would be quite useless to obtain the support of such a section by deluding them with the extravagant promises of the ordinary Socialist

orator, for this could only lead to the destruction, by revolt, of the new scheme almost before it was in full operation. It would be necessary that the supporters of the scheme should clearly understand that having once chosen a ruler or ruling council, this authority must necessarily receive unquestioning obedience in every detail of social life. For the authority would have to control, as trustee for the community, the whole of its land and capital; and would therefore have to become directly responsible for carrying on the whole process of production and distribution within the area occupied by the community. The central authority would, as a necessary consequence of this, become directly responsible for the well-being of every member of the community, and would therefore have to be entrusted with the full control of the social life of every citizen in all its aspects.

Since the central authority would be responsible for the maintenance and well-being of every citizen it would have, not only to allocate to each citizen his share in the work of the community, and to compel him to execute it, but also to restrict the population within limits which would make it possible to assure adequate maintenance to all. Professor Karl Pearson, the ablest and most scientific of Socialist thinkers, writes:

"With the sex relationship, so long as it does not result in children, we hold that the State of the future will in no wise interfere; but when it does result in children, then the State will have a right to interfere, and this on two grounds: first, because the question of population bears on the happiness of society as a whole; and secondly, because child-bearing enforces for a longer or shorter interval economic dependence upon the woman."[1] And again: "It will profit little that the social man and woman without constraint limit the number of their

[1] *The Ethic of Free-thought*: Socialism and Sex, p. 440.

offspring, if large anti-social sections of society continue to bring any number of unneeded human beings into the world."[1]

The necessity of such limitation of the birth-rate would be the more essential in that the introduction of Socialism would necessarily lead to a great decrease in the total volume of production. For under Socialism the inducement of reward would be replaced by that of compulsion, in other words, free labour would be replaced by slave labour, and all experience shows that slave labour, which is work done under compulsion, is far less productive than free labour, which is work done for reward; and further, that the least efficient and least progressive method of management is management by officials. In the case of a thickly populated country, therefore, the advent of Socialism would involve, not only a legislative restriction of the birth-rate enforced by drastic penalties, but a great fall in the general standard of material comfort and enjoyment. The whole community would have to live the simple life in its barest and least alluring form.

In order to obtain such more than dubious benefits the mass of the community would be compelled to place itself "completely at the mercy of a comparatively small and highly centralized body of organizers and administrators entrusted with such powers as no human hands can safely or righteously wield."[2] The government would relieve individual citizens of all their responsibilities, material and moral, and would deprive them of the means of fulfilling them for themselves. The only civic virtue for the mass of citizens would be obedience, and the more habitual and instinctive this obedience became, the more smoothly would the system work. Even with the kindliest and wisest rulers, therefore, the mass of

[1] *The Ethic of Free-Thought*, p. 438.
[2] Professor Flint: *Socialism*, p. 522.

citizens would tend to become ever more automatic, ever more completely assimilating the habit of blind unquestioning obedience. Personal initiative would be confined to the rulers, there would be no scope for its exercise by the subject mass of citizens. The faculty of reason, which is the source of all initiative, would therefore gradually die away and be replaced by habit, in other words, by instinct, and when the process was complete, the mass of citizens would have lost everything which constitutes human personality, and would have descended to the animal level, for reason is the essential basis of personality. They would therefore entirely lose those higher faculties which express themselves in all mankind in the form of religion, and in the few in the forms of philosophy, science, literature, and art.

At every stage of the process the working of the system would proceed more smoothly, so that the rulers would naturally do all in their power to accelerate it, for at every successive stage the subject mass would become less capable of interfering with their rulers. In such a system there would be no possibility of rising from the subject class to the ruling class, though as the numbers of the ruling class increased the weaker surplus might be driven down into the class below. This system, State Socialism, as I have called it elsewhere, is the only feasible form of Socialism, as is fully recognized by all Socialists who are capable of consecutive thought. Many of them really believe that it would be desirable for humanity, for they regard themselves as the destined rulers, and are quite satisfied that the mass of the people would attain to greater happiness under their despotic sway than under any other conceivable conditions. But they do not tell all their thoughts to the ignorant masses to whom they appeal for support. As a writer in the German Socialist journal *Vorwärts* has expressed it: "We must guard against

compromising ourselves before the people by declaring what we really wish: this would be a want of tactics."

This true State Socialism is the only form of Socialism which is seriously contemplated by the more intellectual Socialists as a policy which is practically realizable. But it is not in this form that Socialism is presented to the masses. The leaders confine their writings to more or less vague sketches, from which the shadows are eliminated while at the same time the lights are intensified. The filling in of the details to suit the tastes of the masses is left to writers and speakers whose facile pens and glib tongues are quite untrammelled by the limitations of logic and experience, so that they can colour the picture in accordance with the tastes of their readers and auditors and the exuberance of their own imagination. Socialism as presented by these minor scribes and orators promises a superabundance of luxury and enjoyment with an almost vanishing minimum of work and discipline. These promises are largely based upon Karl Marx's *Capital,* which has been called the Socialist Bible. His economic dogmas, and his doctrine of a class war founded upon them, have been abandoned as untenable by the responsible leaders, although the majority of them still accept his equally untenable *Historic Materialism,* the foundation of which is the pseudophilosophy of atheistic Materialism.[1] The propagandists of all the different Socialist parties hold out these extravagant promises founded on patent economic fallacies. It is on the question of the government of the Socialist State that the real divergence in the teaching of the various Socialist groups is to be observed, and from this point of view all these groups may be classified into three main divisions, and this classification

[1] A full account of these dogmas, and a complete exposure of their fallacies, will be found in *The Superstition called Socialism.*

applies equally well to Socialism wherever it exists at the present time: in England and Scotland; on the Continent of Europe; in the United States; and in Japan.

1. The Social Democrats profess a belief in a Socialist State existing under a Democratic Government. The absurdity of such a combination will be obvious to all who have intelligently read this volume, and if the detailed demonstration be desired, it will be found in *The Impossibility of Social Democracy*, by Dr. Schäffle.

2. The Communal Anarchists, or Ideal Socialists, as they also call themselves, profess a belief in the combination of Anarchy with complete Communism, which is even more obviously absurd than the combination of Socialism and Democracy. All property is to belong equally to every one, but there is to be no central government to hold and handle it, for according to their views there is to be no government except the local parish councils.

3. The remaining group I have called Nebulous Socialists because, in their propaganda to the masses, they express no definite opinions with respect to the nature of the government of the Socialist State. In the case of a large proportion of the rank and file propagandists the reason for this is that they have never formed, or been taught, any definite opinions on the question. Most of the members of the Fabian Society, and other comparatively intellectual propagandists, are quite aware that a rigid State Socialism under a strong and despotic rule is the only possible form of socialistic State. They are, however, equally aware that it would be bad tactics to proclaim this to the masses. Therefore, as a matter of expediency, they adopt the nebulous attitude which is a matter of necessity with the ordinary run of nebulous Socialists, because they are incapable of arriving at the truth of their own initiative, and the leaders

have taught them, not what they themselves believe, but what they wish to be proclaimed to the masses.

The Social Democrats and Communal Anarchists of England and Scotland have recently dissolved their separate organizations and combined to form a united organization under the name of the British Socialist Party. At first sight a combination between two parties with ideals in such absolute opposition would appear scarcely conceivable: for the aim of the Social Democrats is the exaltation of the power of the State to the extent of ultimate deification, while the aim of the Communal Anarchists is the practical destruction of the State—its degradation to isolated parish councils. But both parties are agreed that the only path by which either of the opposed ideals could possibly be attained would lead through the disruption and ultimate destruction of civilization and organized industry. And the programme of the British Socialist Party is entirely destructive, for the simple reason that no agreement could be arrived at, with respect to any constructive proposals, at the conference at which the amalgamation was formally effected. Moreover, the leaders of the British Communal Anarchists believe that it is only through an intermediate condition of State Socialism that their own ideal can be attained. Mr. Robert Blatchford, their chief, affirms that State Socialism "would be hell", and, with astonishing candour, indicates his opinion that the attainment of his own ideal would be the result of rebellion and civil war, caused by the extreme misery and destitution of the working classes, which would be the inevitable consequence of even the partial success of State Socialism.[1] Other Communal Anarchists state their belief that when a community has been completely organized under the despotic government which State Socialism involves, the rulers will voluntarily resign

[1] For the complete demonstration of this from Mr. Blatchford's writings, see *The Superstition called Socialism*, pp. 99, 108–17.

their privileged positions, and lose themselves in the mass of the people, and that everything will then go on automatically without any further need for government. Both these beliefs involve the assumption that the enslavement of a human community would develop within it capacities for individual self-control and mutual co-operation to an extent hitherto unknown among men. The former alternative, moreover, involves the further assumption that a community which had allowed itself to be reduced to abject slavery by its self-chosen rulers would be capable of throwing off their yoke of its own initiative. The latter alternative admittedly depends on the assumption that the rulers, after establishing themselves in a privileged position of unassailable strength, would willingly relinquish it from purely altruistic motives. Both, moreover, are dependent on the supplementary assumption that no foreign State would be tempted to take advantage of the helpless automatism of the socialistic community, by assuming control of its administration, and compelling its members to labour for the benefit of their new masters. And this would be as simple and easy an operation as that by which the bee-master assumes control of a swarm of bees and utilizes the results of its labour.

Such proposals are so intrinsically absurd that they are very generally regarded as unworthy of serious consideration. But this is a great mistake and a dangerous one. There are comparatively few who think for themselves; many who think as those think with whom they come into contact; and many more who, practically, do not think at all. And under democratic systems of representative government the selection of rulers largely depends on the second and third class, who are swayed mainly by their emotions. It is most essential to the success and stability of democratic government that these classes should receive an education which will lead them in the direction of

thinking rationally, and that reliable sources of information should be made generally accessible to them. The present system of primary education, while partially opening the pathway to knowledge by teaching children to read, affects little or nothing in the way of training their minds and building up their character. Instead of this, their memories are crammed with miscellaneous assortments of undigested information, and little or no attempt is made either to develop the flexibility and general adaptivity of mind which is essential to their industrial efficiency under modern conditions, or to qualify them to distinguish between the true and the false in what is presented to them. Educational reform is one of the crying needs of the present day, and one which is almost totally neglected.

The exponents of Communal Anarchism base their futile expectations on Marx's application of the pseudophilosophy of materialistic Determinism to the social development of mankind, which is known as his Materialistic Conception of History. According to this view, as his disciple Ferri expresses it:

"The economic conditions—which are the resultant of the energies and ethnological aptitudes acting in a given physical environment—are the determinative basis of all moral, juridical, and political manifestations of human, individual, and social life." [1]

Sir Leslie Stephen very rightly observed that "Materialism is not so much an error as an absurdity"; but even if Marx's economic Determinism were a true conception it would in no way rationalize either the actions or the expectations of Communal Anarchists. In the first place, the whole of their socialistic propaganda would be absolutely futile, and therefore merely wasted effort. The true philosophy of life would be that of the loafer who takes life as it

[1] *Socialism and Positive Science*, by Enrico Ferri, edited by J. Ramsay MacDonald, p. 144.

comes and troubles not at all. For if man were entirely determined by his economic environment, he could exert no influence upon himself or his surroundings, and what we call his character would be nothing more than the aggregate of his observed reactions to his environment. Moreover, the expectation that a community of slaves would suddenly rise, throw off the yoke of servitude, and yet continue to live their ordered existence, would be an irrational one, for the simple and sufficient reason that such a sequence of events being unknown in past experience there is no basis for anticipating it in the future. The expectation that the rulers would voluntary abnegate their privileged status would be irrational for a precisely similar reason.

The keynote of Christianity is the insistence on individual moral responsibility, the essential basis of which is man's personality, his existence as a free will-reason derived from the personality of God Himself. To attempt to combine the profession of Christianity with the acceptance of a scheme of life in which personality must either be denied altogether or eliminated and replaced by instinctive habit is therefore the very acme of illogical inconsistency. It would be every whit as reasonable to attempt to combine the profession of Christianity with the formal profession of Atheism, and I am informed that there actually exists a sect the members of which call themselves Christian Atheists, and take themselves quite seriously. There are certainly men who call themselves Christian Socialists, and insist that their Socialism is not a special brand of their own. The Church Socialist League does this, and in the opening number of its new periodical *The Church Socialist*, of January 1912, this attitude is punctuated by the inclusion, without comment or note of warning, of Karl Marx's *Capital*, as one of the works recommended for study. The exhibition of such mis-

chievous folly and ineptitude on the part of clergymen occupying responsible positions in the National Church of our country affords a painful object-lesson in the results of an undue relaxation of Church discipline.

Syndicalism

The objective of Syndicalism, or Industrial Unionism, as it is termed in the United States, is the ownership and administration of the various industries in a country by the groups of operatives respectively engaged in them—that the coal mines of any country should be owned and controlled by the coal-miners, the cotton mills by the cotton operatives, and so on. The method by which the Syndicalists hope to obtain their object consists in a complete transformation of trade union organization, all the workers in each industry being first grouped into a single industrial union, and these unions being then united into one central organization which, when sufficiently powerful, is to bring about a general strike of all the members, and so declare war against all sections of society outside the organization.

Syndicalism does not stand for the *socialization of the means of production, distribution, and exchange*, but for their ownership and administration by more or less independent groups loosely associated together. Moreover, it does not, as Communal Anarchism does, propose to attain its objective by the passage of the community through a preliminary stage of State Socialism. Theoretically, therefore, it is not to be regarded as a phase of Socialism. Communal Anarchism professes to stand for the socialization formula, although its ultimate aim is ownership and administration, not by the community, but by isolated parish councils, and is therefore a direct negation of Socialism. From the point of view of their ultimate aims neither Communal Anarchism nor Syndicalism could be

regarded as phases of Socialism. The only difference between them consists in the fact that their objectives are ownership and administration by local groups and by industrial groups, respectively. Both Communal Anarchists and Syndicalists are welcomed as allies by many revolutionary State Socialists, because they are all agreed in seeking the attainment of their several ideals through the disorganization of industry and the promotion of every kind of disorder. Evolutionary Socialists, on the other hand, hope to attain their ideal through gradual orderly change, and therefore they have no real sympathy with the methods of the revolutionary groups, and are altogether opposed to the absurd and suicidal proposal of the general strike. Indeed, its absurdities could hardly be more trenchantly exposed than in J. Ramsay MacDonald's article in *The Socialist Review* for October, 1911, in which he wrote:

"The old revolutionist knew his business, faced the facts, laid his plans; the new revolutionist does none of these necessary things. . . . The Syndicalists make the fatal mistake of assuming that time will be on their side. Exactly the opposite. Time will work against them. However complete the general strike is to be, it is only to affect, even to begin with, a majority. There will be a minority holding the same opinions as were expressed by the suburban dwellers during the recent railway troubles. They will represent the resistance which society must always offer to sudden change. Then there will be a great number of men who will become unemployed without in any way sympathizing with the strike or its purposes. The striker, every day that passes, becomes, in the eyes of an increasing number of people, not the saviour but the enemy of society. His assumption is that, as the days go by, society will become more helpless in his hands; but the fact is that after the first two or three days society will

begin to organize itself against him, because society, as well as the individual, is moved by the will to live. The fact is that the assumption of a progressive paralysis is false. Society will at once take steps to recover command of itself. It will not yield to the general strike; it will resist it. On the day of his first triumph, when he declares his strike, the Syndicalist signs his own death-warrant and puts the noose around his own neck. The new revolution which Syndicalism and its advocates of the Industrial Workers of the World contemplates has avoided none of the errors and pitfalls of the old, but it has added to them an escapade of the nursery mind. . . . The hospitality which the Socialist movement has offered so generously to all kinds of cranks and scoundrels because they professed to be in revolt against the existing order has already done our movement much harm. Let it not add Syndicalism to the already too numerous vipers which, in the kindness of its heart, it is warming on its hearthstone."

The recent coal strike, which developed results closely approximating to those which would arise from a general strike, confirmed this forecast in almost every respect.

The ideal of Syndicalism, the development of a system of society of which the structure is to be determined by the various industrial forms of manual labour, is obviously an outcome of Marx's materialistic doctrine of economic Determinism. And Syndicalism has given rise to a pseudophilosophy of its own, of which a French engineer, M. Georges Sorel, is the high priest and apostle. Marx and Engels were students of the philosophy of Hegel, who subsequently came under the influence, first of Feuerbach, and then of the French Materialists. The inversion of their standpoint, resulting from their conversion from Idealism to Materialism, led them to attempt to adapt Hegel's dialectic to a purely materialistic view

of history, according to which Mind, being regarded as a mere bye-product of Matter, might be left out of account, and the whole course of human progress considered as determined by economic conditions only.

Dr. Hammacher has shown, in an able and exhaustive analysis of the system elaborated by Marx and Engels [1], that the inextricable web of difficulties and self-contradictions [2] in which Marx has involved himself is fully accounted for by his attempts to extricate himself from the maze of contradictions in which he and Engels had involved themselves by attempting to construct a system of thought by the rough and ready process of turning Hegel's system upside down by the interchange in the positions of Mind and Matter.

M. Sorel is a student of Bergson, and appears to have conceived, some ten years ago, the brilliant project of resuscitating the discredited system of Marx by infusing new life into it from Bergson's philosophy. His procedure is entirely lacking in the subtlety of Marx; indeed, it would be difficult to imagine anything more crude. Bergson, in view of a supposed [3] conflict between intuition, or the verdict of consciousness, and the intellect, maintains that the latter, having been developed in response to the call for action, is an unreliable guide in the region of knowledge, and must give place to the intuition.

M. Sorel takes Marx's materialistic conception of history and modifies it by the introduction of Bergson's *impulse of life*, the effect of which will be to introduce an element of indetermination into the previously determined system. And, according to Bergson's contentions, this would give a claim to the intuition to override the intellect in any question of abstract thought. This, however, is not enough for

[1] *Das philosophisch-ökonomische System des Marxismus.*
[2] See *The Superstition called Socialism*, chs. i, ii, iv.
[3] See ch. vii, p. 180.

M. Sorel, so he interprets intuition as meaning imagination, or fancy, and claims that it should override the intellect, that is to say the verdict of reason, both in the sphere of knowledge and in that of action. All Marx's dogmas may therefore be accepted in spite of their disproof by reasoned argument, by any one to whom they commend themselves. In the same way, the ideal of Syndicalism, and its attainability by means of the general strike, commending themselves as they do to M. Sorel's fancy, are thereby rendered immune from disproof by reason. It is, purely and simply, the philosophy of the madhouse, and an altogether appropriate foundation for the mad follies of Syndicalism and the general strike.

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